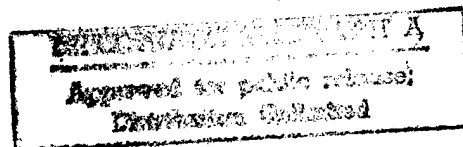287018

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25 August 1982

East Europe Report

SCIENTIFIC AFFAIRS

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EAST EUROPE REPORT

Scientific Affairs

No. 752

Contents

HUNGARY

ACHIEVEMENTS OF SCIENTIST IN PHOTOPROCESS DEVELOPMENT EXAMINED

Sofia TEKHNICHESKO DELO in Bulgarian 3 Jul 82 p 12

[Article by Vasil Simeonov: "Symmetry of the Photoprocess"]

[Text] Experimental and theoretical workers were pleased by the theory of
the mechanism of the photographic process suggested by the two famous physi-
cists Gurney and Mott in 1938. The acceptance of their theory was not guar-
anteed merely by their reputation but was supported by a number of experi-
mental proofs. The strange and unique process in the silver halogens became
more clearly understood and accessible. Previously, assumptions, guesses and
hypotheses had been formulated, but the painful question remained: Why was
it that only silver salts could turn into a hidden image if exposed to light,
an image which became visible after development? Since they were not the
only compounds reacting to light, why only they and not all?

As we know, a photographic emulsion consists of minute crystals of silver
bromide dispersed in gelatin. However, in order to study the mechanism of
the photographic process large silver bromide crystals must be used. Here is
what Gurney and Mott had discovered: When a silver bromide crystal is
exposed to light the light quantum removes an electron from the bromide anion
(known as photoelectron). It moves around the crystal, drops into one of its
imperfect areas -- cracks or twists in the proper structure -- and can remain
there for a while. However, since its charge is negative, it draws to itself
silver ions, particularly those which have left their proper place and have
settled between junctions. The meeting of the electron with the positive ion
yields an atom of silver, which is a structural particle of the so-called
hidden image. Several of these atoms can be developed and form a visible
image, which is the purpose of the photographer. The theory provided an
excellent explanation of a number of photographic effects and no one was
impressed by the fact that it was not quite symmetrical.

At that time Yordan Malinovski had not yet earned his present academic titles
and distinctions, such as BAN [Bulgarian Academy of Sciences] corresponding
member, professor, doctor of chemical sciences, Dimitrov Prise winner, hono-
rary member of the Royal Photographic Society, director of the Central Labo-
ratory for Photographic Processes of the BAN, etc. He was a follower of the
famous Bulgarian scientific school -- the school of physical chemistry --
headed by Academician R. Kaishev. He was also stubborn. He became interes-
ted in the subject and undertook to study it independently. What happens to

the particle from which an electron has been removed? The rather clumsy name under which it is know in Bulgarian is photohole! It should have a positive charge (the electron having taken with it the negative charge, the remainder becomes positive) and should be able "to accomplish" a number of things, such as, for example, to regain its electron instead of letting it form silver atoms and, being simply a bromine atom, could have a destructive effect on the silver compounds, since bromine and silver react easily. However, no such thing develops in practice, for which reason it is accepted that this photohole plays no role in the photoprocess.

Yordan Malinovski's view is somewhat different. If the photohole plays no role it means that it is either slow moving (does not move in the crystal) or else that it exists for a very short time. Was this the case? The original method developed for detecting and determining the parameters of photoholes is already know as the method of Malinovski and his associates. What was more important however, was that contrary to the expectations of the theoreticians, who had neglected the holes, they proved to be both mobile and viable. Consequently, the actual photoemulsions create conditions which remove them from the process of formation of the latent image. However, to ignore their significance means to violate the symmetry of the process!

Yes, Yordan Malinovski was convinced that there must be symmetry. Therefore, when photoelectrons are neutralized so should photoholes. This marked the start of the hard road to supplementing and broadening a generally accepted theory. How are the holes "trapped," thus providing a "terrain" for the electrons and the silver ions, which enables them to form a latent (hidden) image? The most attractive theory would be for the holes to become linked with negative-charge vacancies (areas in the crystal grid left behind after the silver ion has left, as it is positive and consequently leaves behind a negative charge). This would make everything quite symmetrical. However, the existence of such a combination was not proved experimentally, although it was possible on the basis of most general logical considerations and, naturally, the experimental data on the nature of the photoholes!

Yordan Malinovski was able to prove the symmetrical nature of the photoprocess. Real crystals always include admixtures of copper or iron atoms, for example. We know that they participate in the oxidation and reduction processes related to losing or gaining electrons. Quite likely, these admixtures were "traps" for the holes. Consider a copper ion which becomes linked with a hole. The result is a copper ion with a higher positive valence. The same applies to the iron ion. The resulting ions, which carry an additional positive charge from the "trapped" photohole, can easily trap a negatively charged vacancy. This assumption perfectly fits with experimental results. The pattern followed by the photoprocess becomes symmetrical -- the photoelectron is trapped and neutralized by the silver ions. The photohole is also trapped with the help of admixtures, which are always present in real crystals, and is then neutralized by the vacancy of the moving silver ion! This represent the full symmetrical system. It explains why the very pure silver bromide monocrystals are virtually insensitive to light. The electron and the hole recombine before moving along their symmetrical paths, leading, in the final account, to the developed image.

One last question remained: Would the admixtures capable of retaining the holes not come to an end after a while? Once again Y. Malinovski proved that the complex between the admixture and the hole becomes diffused along the surface and breaks down releasing the hole (which is chemically the equivalent of active bromine). This special situation on the surface of the crystal has been proved with original and universally aknowledged experiments. However, everything so far defines only one aspect of the achievement -- its theoretical part, the play of a logical mind, confirmed through the dexterity of the experimenter. Studies indicated that the photoholes can play a special role in the photoprocess, both active and independent. If a layer of silver, which can be developed, is deposited on the surface of the crystal, after the exposure it will be reached by holes which will react with the silver. The result of the development is a positive print of the original. This leads to "hole photography" (a new type photosystem) and the conclusion that other light-sensitive compounds can produce an image with the help of photoholes. This marked the beginning of a new direction in theoretical and practical photography.

Today the photographic world is speaking of a symmetrical system and every specialist knows that it is owed to the Bulgarian specialist Yordan Malinovski. The path which lead to it proved that scientific gaps exist even in the most proven theories and most prestigious reputations.

DEPUTY MINISTER VIEWS CHEMICAL INDUSTRY DEVELOPMENTS

Prague RUDE PRAVO in Czech 25 Jun 82 p 5

[Interview with docent Eng Jiri Marcin, CSc, deputy minister of CSR industry, by Eva Sadilkova; date and place not specified]

[Text] The CSR chemical industry met last year's quotas. In comparison with 1980, it achieved an increase in adjusted value added by 6.8 percent and in profit by 8.4 percent. Productivity of labor in adjusted value added increased by 6.6 percent. The positive fact is that these results were attained owing to a 77 percent saving of material, where in comparison with the previous year there occurred a decrease by 1.35 percent. We asked docent Eng Jiri Marcin, deputy minister of CSR industry, what further tasks are in store for the CSR chemical industry in the current year and the subsequent years of the current five-year plan.

[Question] In what areas are customers for CSR chemical industry products satisfied?

[Answer] We have lately introduced and expanded production of a number of chemical and preparations for the development of animal production, e.g., growth stimulators, a vitamin D2 concentrate, etc. Construction of a large-capacity unit for the production of dicalcium phosphate fodder is underway. For plant production we are preparing herbicides that up to now had to be imported. In 1982 we shall substantially increase deliveries of means for ensiling fodder grasses, we introduced experimental production of the new preparation Silko, etc.

In regards to the machining, electrotechnical and construction industries I consider the decisive contribution of the chemical industry to be the significant increase in the production of basic plastics which made it possible to reduce their importation to one-third of the original volume.

[Question] What, on the other hand, are they not satisfied with?

[Answer] Agricultural personnel are justified in criticizing us, because we still do not satisfactorily meet their demands as to the volume of production.

In some cases they are also not satisfied with the structure of the supplied industrial fertilizers. We implemented a number of measures that will bring about gradual improvement in the quality of fertilizers, but we still will have to concentrate our efforts on this area.

[Question] How about direct deliveries for the consumer goods market?

[Answer] I am convinced that in this regard consumers appreciated ample availability of tires, increased deliveries of goods made of plastics, such as bobsleds for children, 50,000 of which were supplied to sales outlets last year. There is finally no shortage of squeegees for cars, supplies of some photographic materials were significantly increased. Shortages persist in bicycle tires, some products made of molded rubber and inflatable toys. We are dealing in close cooperation with the Association of Slovak Production Cooperatives with increasing deliveries of inexpensive raincoats made of plastics.

[Question] Which sectors of the chemical industry will be accorded priority for their development in the current five-year plan?

[Answer] Mainly production of certain special plastics. Their production will be implemented based on our own research results. It involves, e.g., alkaline polyamide, grafted polypropylene, etc.

On behalf of the electrotechnical industry we envision expanding the production of pure gases, solutions sensitive to light for use in printed circuits, scintillation units, oxygen crystals and sapphire profiles for microelectronics, etc. After completion of the facility in Optimit Odra the rubber industry should achieve a substantial improvement in meeting the demand for molded rubber products, particularly rubber hoses.

[Question] In recent past there was a considerable increase in cooperation between our and the Soviet chemical industry. What is it primarily constituted by?

[Answer] In the current five-year plan the Soviet Union will provide us with, among other things, instrumentation and automated systems for control of technological processes for restructuring 63 enterprises and plants throughout the republic. We want subsequently to export to the USSR, but also to other CEMA countries, more products of higher chemistry, organic pigments, coating materials which make low demands on energy. Conversely, we will import primarily from the Soviet Union products making high demands on energy and, of course, raw materials, mainly crude oil.

Scientific and technical cooperation between our republic and the USSR has also been developing very successfully, after all, it has a long-standing tradition in the chemical sector. Both countries are at the present jointly tackling 47 tasks pertaining to, the production of organic pigments and semifinished products for their production, auxiliary systems for the rubber industry, chemically pure substances, chemical fibers, synthetic minerals, vitreous materials and household chemicals. Some of the solutions

have already produced concrete results. For example, documentation was worked out and experimental pilot production units were set up for producing some of the auxiliary systems for the rubber industry, which will be implemented in the CSSR as specialized production to meet the needs of the Soviet Union and of other socialist countries. Already in the current five-year plan it will be precisely deliveries of these products (antioxidants and plasticizers) that will cover a considerable part of our import needs for products with high energy demands from the Soviet Union.

Similarly developed is also mutual cooperation in the sector of crude oil processing and petrochemistry, wherein 10 tasks are currently dealth with, and in the sector of paper and pulp industry. Herein both countries deal with new methods for production of pulp that would reduce pollution of waste waters and air pollution. Technical and scientific cooperation between the CSSR and USSR is also contributing toward gradual elimination of dependence on importation of some chemical products from nonsocialist countries.

[Question] The chemical fair in Bratislava will open on Saturday. What will enterprises of the CSR chemical industry bring to Incheba 82?

[Answer] At this year's Chemopetrol exposition, customers will get a chance to familiarize themselves with, a new preparation, Gestrofan, for controlling the birth rate of horned cattle and pigs. Another new product is a preparation to be used in the production of automotive gasolines to gradually reduce the lead compound contents. For the driving public there will be car oil, Super-Mogul-Stabil to extend the time between oil change while maintaining good lubricating properties throughout all operations. A new type of mixture and a highly effective fertilizer, Enpekasol, is destined for small growers.

VHJ [economic production unit] Unichem will familiarize customers with a new improved anticorrosive preparation for automobiles. Olachindox, is aimed for agriculture—as a non-antibiotic stimulator to increase animal production. Health personnel will certainly appreciate the set of diagnostic strips, Phan.

A significant contribution made by the chemical industry to the therapy of some oncological diseases is the preparation Platidian-R from Lacheme Brno. All of the mentioned products are already in production. VHJ Czech Rubber and Plastic Plants will exhibit new types of passenger car, truck, tractor and special tires. The clothing industry and its customers will surely appreciate the new type of imitation leather Vinytol, which has improved utilitarian properties and makes a lesser demand on foreign exchange resources for importation of raw materials. The new types of tires and improved types of imitation leather will be introduced into routine production in the latter half of the current year.

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CSO: 2404/59

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EFFECTS OF CLIMATE, SOIL CONDITIONS ON WHEAT QUALITY ANALYZED

Prague, ROSTLINNA VYROBA in Czech No 2, Feb 82 pp 133-139

[Article by J Prugar and V Hyza:* "Effect of Climate and Soil Conditions on Wheat Quality"]

[Excerpts] The concept of "climate" embraces a variety of different natural factors which affect the biochemistry of wheat in varying degrees. They include moisture, temperature, sunlight, the related factor of soil solution concentrations, and a complex of soil properties created through prolonged interaction between geological and meteorological factors in a given area.

The soil, its structure and its humus and available nutrient content have an extremely important effect on wheat quality. Under given climatic conditions, the condition and composition of the soil have a very fundamental effect on plant biochemistry and on the utlimate composition of the grain. As a result, within a given agricultural organization, a given variety will show considerable differences in quality in locations somewhat distant from each other as a result of differences in soil quality. The soil can do much to make up for unfavorable climatic conditions.

The effect of soil moisture manifests itself in both yield and quality. While moisture during the growth period promotes good development and growth and accordingly high yields, it usually decreases the amounts of nitrogen compounds in the grain and leads to poor results in other quality factors as well.

High environmental moisture during ripening of the grain causes saccharide formation to predominate so that the grains are large and their relative nitrogen content falls. Also relevant is the effect of length of the growth period on the nitrogen content of the grain: the longer the growth period (whether because of cold, moist weather or the nature of the variety), the longer the period during which the amount of dry material in the grain increases, and accordingly the greater the yield.

Higher temperatures promote plant growth and thus the accumulation of proteins and saccharides. In this case the respiration rate increase faster than saccharide deposition and accordingly the protein-to-starch ratio increases.

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*[Prugar of Research Institute of Soil Science and Plant Nutrition (VUPVR), Bratislava; Hyza of Grain Research and Breeding Institute (VSUO), Kromeviz]

In addition, higher temperatures also favor microbial nitrification processes, which in turn enrich the soil and the plants in nitrogen. In addition, the temperature has a considerable effect on the plants' absorption of mineral nutrients from the soil, and changes in the intensity of mineral nutrition show up both in yields and in the chemical composition of the grain.

Temperature has an effect on the creation of the physical and physicochemical properties of grain which are so important for preparation, and this is even more important than its effect on the ultimate quantity of protein in the grain. An adequate supply of thermal energy is essential for normal ripening, which involves the formation of complex high-molecular-weight compounds from simpler building blocks. The temperature is critical to the colloidal material of the ripening grain. Grain which has considerable moisture in the waxy-ripe stage gradually begins to lose it, not only as free water, but also as water liberated in condensation reactions. The gluten begins to become more solid, because the colloidal processes in the grain proteins involve coagulation. But if the temperature during the ripening period exceeds the optimum, the grain becomes too dry and the protein structures become too hard, which shows up in the flour as decreased swelling ability in the gluten. The ideal weather for high yields and good grain quality thus entails abundant precipitation before flowering, followed by high air temperatures and low but adequate soil moisture.

Little attention has thus far been devoted to the effect of climate and soil factors on grain quality in the Czechoslovak literature. In the 1950's, Prugar of VURV [Research Institute of Crop Production] in Prague investigated the chemical composition and processing qualities of 24 varieties of winter and spring wheat in 21 localities with an extremely wide range of ecological conditions over a 2-year period. Subsequent studies by VURV systematically investigated the quality of Czechoslovak grains, while devoting attention to the relationship between quality indicators and climatic and meteorological effects on the crop. Prugar and Sasek (1969) attempted to find the interrelationships between the effects of ecological conditions at five locations in different production areas for three wheat varieties with different processing qualities. The same aim was addressed in the joint research of staff members of VURV Prague and VUO [Research Institute of Grain Growing] Kromeriz, which studied the effect of meteorological factors on processing quality of a wide selection of varieties in one location and used starch gel electrophoresis to analyze the proteins extracted. The results obtained by UKSUP [expansion unknown] Bratislava in variety trials with winter wheat in the corn-producing area of East Slovakia in 1969-1971 were evaluated by Baxa (1974). They confirmed that a moderator temperature without major deviations throughout the period from earing to complete maturity was optimal for grain quality. In the last 10 days before harvesting, evaporation should exceed precipitation. Thus hot dry weather--but not extremely high temperatures--is most favorable in the maturation period.

Among recent studies in this country we should mention those of Prochazka (1976) and Prochazka and Dudasha (1978), in which many years' data from variety trials, in various soil and climatic conditions, of the Mironovska variety of winter wheat are analyzed. These papers too conclude that high temperatures and low precipitation during grain formation and ripening improve quality, while abnormally high temperatures produce an overall worsening of quality. Skopek and Kastankova (1978) describe the variation in quality indices of wheat from various areas of Bohemia and Moravia.

Recent studies on the suitability of areas of Czechoslovakia for cultivation of bread wheat include those of Hyza (1981), Prugar (1981) and Vonka and Hyza (1979).

Data and Methods

The data for the map of local specialization in wheat cultivation in terms of quality were accumulated from our own work and the other domestic publications cited, and from data of the State Quality Inspectorates for Agricultural Products [both Czech and Slovak Republics] and of the agricultural procurement and supply enterprises, starting with 1954.

The whole of Czechoslovak was mapped out okres by okres by entering mutually comparable data (same evaluator, same year, some quality indicator). The sets of quality criteria differed by source: data from research papers were more extensive, including for example the results of farinographic evaluation, practical baking tests and the like, while those from other sources usually provided only basic data on baking quality in terms of gluten content and quality.

We calculated an average for each set of comparable results and then divided the data for the individual locations into three quality groups:

A--values at least 10 percent above the average;

B--values within 10 percent of the average;

C--values at least 10 percent below the average.

Thus each okres which was evaluated received a classification or "grade" for each set of data. The number of grades differed depending on data availability. For some okreses in the Czech Republic more than 20 quality indices were available, while the average in the Slovak republic was about 10 (for example, studies of the development of grain quality were not available in the SSR in the same detail as those provided by SIJ ZV [State Quality Inspectorate of Agricultural Products] in the Czech Republic.

Then, according to the average of the quality grades (ABC) we assigned each okres to one of five favorability classes in terms of its suitability for cultivation of bread wheat: excellent, very good, generally favorable, generally unfavorable, and unfavorable.

In the next stage of the work, in cooperation with the former Department of Soil Science in VURV (Dr Milan Tomasek, Csc), we refined the this preliminary version by comparing it with data on the soil map of Czechoslovakia (scale: 1 : 500,000). Our preliminary classification held up very well in this comparison, and only a few minor corrections were needed. The individual okreses were then broken down further in terms of predominating soil and climatic characteristics, producing a sketch map which was then worked up into final graphic form (Prugar, 1981).
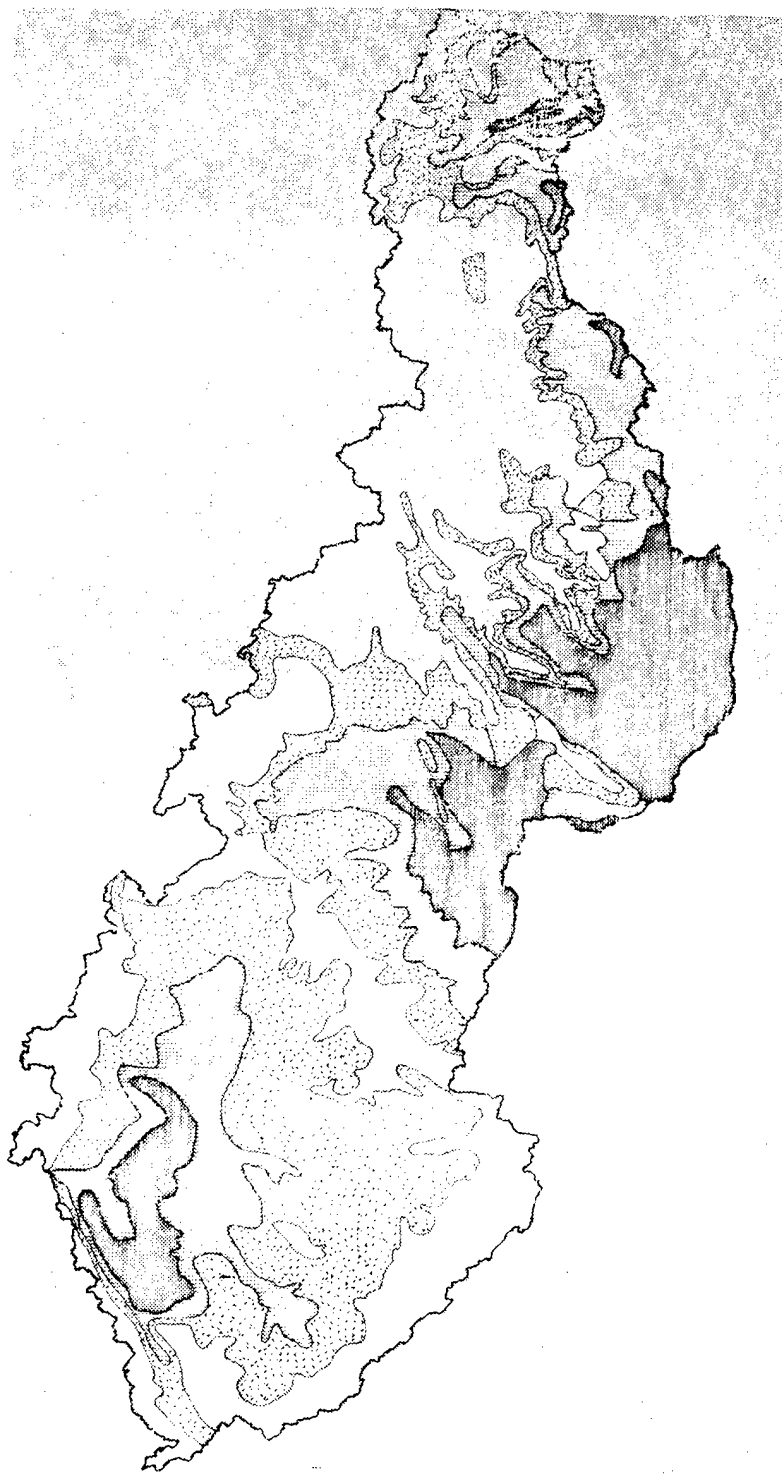
Fig 1. Local specialization in bread wheat production in Czechoslovakia.

The second variant was developed on the basis of farinographic analyses of representative, comparable wheat samples taken during the regular wheat quality testing of the State Quality Inspectorate of Agricultural Products in the CSR, Data from GR PZN [expansion unknown] in Bratislava were used to evaluate product quality in the SSR.

As in the first variant, the information was entered on the map by okreses and a further breakdown was made in terms of data on weather and soil conditions. We also made use of five 5-year averages for the 7-month growth period encompassing tillering, earing, grain formation, ripening and harvest. In addition, we compared 30-year average hydrothermic coefficients for the months of June, July and August. These figures are in very good agreement with the analytical results from determination of the rheological qualities of doughs. This produced the final form of the second map variant.

The formula for calculating the hydrothermic coefficient was

$$HTK = \frac{R}{0.1 \; TS10}$$

where R = precipitation and TS10 = sum of temperatures during period with temperature higher than 10° C.

In the next stage, both sets of data were compared and after further refining of the area breakdown of the Slovak Republic according to data from VUPVR [Research Institute of Soil Science and Plant Nutrition] Bratislava, we produced the final map (Fig. 1) of areal specialization in the production of break wheat in Czechoslovakia, which is presented here and is also available in a color edition at a scale of 1 : 100,000.

Results and Discussion

Study of the effects of climatic conditions and soil types on both the qualitative and quantitative aspects of grain production is of great importance under our country's circumstances. Czechoslovakia has an extremely varied geography, not only in terms of elevation, but also in terms of soil type. One practical consequence of this variety is that conditions in different area are favorable for successful, economically efficient cultivation of different sets of economically important crops. Experience indicates that not only individual crops, but even their varieties, may be less suitable for one area than for another, and accordingly that some varieties are best suited for cultivation in particular areas, where they can develop most fully and give the highest yields of the best quality product. Each variety has its own particular environmental requirements, i.e., for light, heat, moisture, nutrients and the like, and some areas may suit these requirements better than others.

The grain production sector can meet the requirements of the milling and baking industries on the one hand, and of the feeds industry on the other, only if it uses the mix of wheat varieties which produces optimal quality and consistently makes use of cultivation techniques.

Soil and Climatic Classification of Areas by Suitability for Cultivation of Bread Wheat

Areas with Very Good Conditions

According to agroclimatic conditions, the "rather warm" (1.1.3 according to Kurpelova et al., 1975) and "fairly warm" (1.1.4 areas in Bohemia, the "quite warm" (1.1.2) and "rather warm" (1.1.3) areas in Moravia and the "very warm" (1.1.1) areas in Slovakia are in this class. The main subregions are "quite dry" and "very dry".

This area has a long-term spring-summer average temperature of 14-17° C (particularly in Slovakia) and low precipitation (250-340 mm). The hydrothermic coefficient for June-August is very low (up to 1.4). These areas have high total sunlight, particularly in southern Slovakia (more than 1,500 hours during the spring and summer growth period), southern Moravia (1400-1500 hours), and northwest Bohemia (1300-1400 hours). The soil types are primarily meadow soils, chernozems, brown forest soils and rendzinas.

Areas with Generally Suitable Conditions

In agroclimatic terms these are "fairly warm" to "rather warm" areas in Bohemia and Morovia or "rather warm" to "Quite warm" areas in Slovakia and are subdividied into "relatively dry" and "quite dry" classes. The average spring-summer temperature is 13-15° C, precipitation is 350-400 mm in Moravia and Slovakia, and up to 350 mm in Bohemia, and the hydrothermic coefficient is 1.3-1.5. The quantity of sunlight ranges from 1400 to 1500 hours in Slovakia and from 1300 to 1400 hours in the Bohemian area. The soil types are brown forest soils, meadow soils and rendzinas, as well as chernozems in Bohemia.

Areas with Generally Unfavorable Conditions

In agroclimatic terms, these belong to the "moderately warm" (1.2.2) to "fairly warm" areas, with "moderately moist" to "moderately dry" subcategories. The average spring-summer temperature is 12-14° C, precipitation is 400-500 mm, or less in Bohemia, and the hydrothermic coefficient for June-August is 1.5-1.8; sunshine in the spring-summer growth period amounts to 1300-1400 hours in Slovakia and 1200-1300 hours in the Bohemia area. Podzol soils predominate, replaced by brown forest soils in lower areas. This area yields good grain only in extremely favorable years.

Areas with Unsuitable Conditions

These are cold-moist areas with average spring-summer temperatures of 11-13° C (with the exception of mountain areas) and precipitation exceeding 500 mm (with the exception certain areas in Bohemia). The hydrothermic coefficient exceeds 1.8. These areas also have small amounts of sunshine during the spring-summer growth period: up to 1300 hours in Slovakia and up to 1200 hours in the Bohemian area. The soils are for the most part highly podzolized.

We have used data accumulated from the scientific research base, breeding stations, variety trials and testing and procurement organization over the past 25 years to develop a map which will give quality-oriented guidance to

specialists in wheat production in this country. Areas with very good or generally suitable conditions for growing good quality bread wheat are rather uniformly distributed in our country, so that with suitable timing and choice of areas the processing plants can be supplied without the need for long-distance transport.

Developing and adhering to an area plan for the production of wheat for human and animal consumption will avoid the undesirable situation in which wheat of good processing qualities is used as feed and grain suitable only for feed is sent to the mills. The perfection of such an area planning system will yield considerable economic and social benefit by improving milling and baking products.

The agricultural sector was first acquainted with our results at the national conference "For High Yields and High Quality in Wheat Production" held in Prague in February 1980. Extensive experimental data indicate that area specialization in wheat production oriented toward quality can be rather precisely and suitably achieved in this country. Now that an updated procurement standard for wheat which takes account of quality factors is being introduced, the importance of just the results already discovered by our scientific research base is increasing. The knowledge of area specialization in the production of bread wheat must be used in assigning varieties to growing areas and in the assignment of production tasks in the individual krajs and okreses. Primary use should be made of the areas designated I and II, which can meet most of our country's requirements for grain for human consumption.

We should note the considerable year-to-year variation in meteorological conditions in this country, which necessitates flexible handling of specific situations with reference to the possible need for transport of harvested grain elsewhere. In addition, forecasting of harvest quality should be further developed and refined, following, for example, the technique now being developed by the Grain Research and Breeding Institute in Kromeriz for the use of the Ministry of Agriculture and Foodstuffs.

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CSO: 2402/48

BRIEFS

SYMPOSIUM ON IONIC POLYMERIZATIONS--An international microsymposium on "Progress in Ionic Polymerizations" began at the Institute of Macromolecular Chemistry of the Czechoslovak Academy of Sciences in Prague on 26 July. The microsymposium is being attended by some 70 experts from the USSR, Bulgaria, Hungary, the GDR, Poland, Romania and the CSSR. [Bratislava PRAVDA in Slovak 27 Jul 82 p 2 AU]

POWERPLANT MACHINERY FOR ROMANIA--The CSSR foreign trade enterprise Skodaexport has concluded a contract with the Romanian enterprise Romelectro of Bucharest on the delivery of three thermo-powerplant blocks for the Oradea-2 powerplant. The equipment consists of three boilers, each with a capacity of 420 tons of steam an hour, and burning low-grade Romanian coal, and of three turbogenerators, each with a capacity of 60 MW. [Prague MLADA FRONTA in Czech 28 Jul 82 p 2 AU]

CIVILIAN PLANES FOR USSR--The Let enterprise of Kunovice has supplied more than 300 small civilian aircraft of the L-410 UVP type to the USSR. Currently, the enterprise is working on tailoring the machine to the demands of the Soviet customer. The range of the aircraft will be extended to up to 1,500 km, and some machines will be made especially for the use by the USSR fishing fleet, for fire-fighting, for deployment as flying ambulances, for photogrammetric experts, and for use in the Arctic region with skiis as landing gear. [Prague PRACE in Czech 28 Jul 82 p 3 AU]

CSO: 2402/66

EC 1055M COMPUTER SYSTEM DESCRIBED

Overview of System

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No. 1, Feb 81 p 1

/Overview of EC 1055M computer system by Walter Muench, member, RECHENTECHNIK-DATENVERARBEITUNG editorial advisory board: "EC 1055M." Translations of articles describing the components of the system described below are published following this introductory article. Translations of the articles describing the operating systems will be published in a subsequent issue of the EAST EUROPE REPORT: SCIENTIFIC AFFAIRS/

/Text/ Everywhere in our republic, great services are being rendered to strengthen the republic in preparation for the 10th Party Congress of the SED. For the employees of the State Enterprise Combine Robotron, it is also incumbent by means of the most recent information from science and technology, to produce still more efficiently, and to fabricate still more available final products with a lesser expenditure of materials and energy. Considerable results were achieved along this route.

This edition of "Computer Technology/Data Processing" reports in detail concerning a new product of the creative work of the employees of the Combine - the Model EC 1055M. This model will for the first time be presented to the public at the Leipzig Spring Exhibition in 1981.

This model is more powerful than its predecessor. For example, only two cabinets are required for the entral unit - a convincing contribution to materials economy. Due to the use of modern components, less energy is consumed.

The EC 1055M is a development of the ESER (RYAD). We recall once again: During the years 1978 through 1980, the models EC 1015, EC 1025, EC 1035, EC 1045, and EC 1055 of the RYAD, Series 2, were subjected to a joint test and were transferred to production. In different degrees, modernization stages have since then begun for the individual models. While retaining the basic principles specified for Series 2 (general technical requirements), they strive for an increase of utility corresponding to increasing user requirements.

As the result of modernization, Model EC 1055M was developed from Model EC 1055. It is essentially distinguished by the following new components:

Central unit EC 2655M with a main storage capacity up to 4 M bytes and a loadable microprogram memory

Operating and service processor EC 7069N with an expanded functional scope, greater operating convenience, and standard floppy disk for loading the microprogram memory of the EC 2655M

Matrix module as additional high power computer unit to perform numerical operations which process large quantities of data - e.g. matrix and vector operations

A further developed operating system OS/ES with improved or new functions, access methods, compilers, etc.

The operating system SVM/ES, which makes it possible to simulate several virtual machines on one real data processing system as well as to operate in the conversational mode and in the batch mode in parallel

Inclusion of further I/O units in the model inventory, e.g. the display screen system EC 7920M, the device station EC 7902M, and the 100-M byte moving head disk EC 5567/EC 5067*.

Although the operating speed of the EC 2655M is not greater than that of the EC 2655, Model EC 1055M, compared to the previous Model EC 1055, has new or improved components and, on this basis, offers an extended application range, higher system performance, and a decisive increase of processing power for special tasks.

Since the new devices can also be connected to the EC 2655, and since the improvements of the basis program support are likewise effective for this central unit, the utility of data processing systems based on the EC 2655 is also increased by using the new model components, taking into account certain functional restrictions.

The operating system SVM/ES is available in RYAD only for the Models EC 1055/ EC 1055M. The operation of the SVM/ES can be speeded up by microprograms of the central unit (SVMA support). This results in favorable effects for the user due to the application of higher integrated memory switching circuits and a new power supply. Despite an increase in the maximum main storage capacity by a factor of two, the number of central unit cabinets could be reduced to two and the power consumption of the central unit could be reduced to about 4.1 kW.

In the following articles rd (computer technology - data processing) will present the new model components in more detail.

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*A paper concerning this unit will be published at a later time.

1982 Leipzig Fair Report

/Report signed "Lo./Pa." on 1982 Leipzig Spring Fair: "High-Performance
Computer Technology--New User Solutions--Data Processing Adapted to the
Work Place/

/Excerpts/ The tradition-rich international place of commerce,
Leipzig, in March 1982 attracted numerous important
manufacturers of writing, computing, and communica-
tions technology. As in the previous years, the
stands in halls 15 and 18, on the terrain of the
technical exhibition, were always besieged by a crowd
of exhibition guests eager for knowledge, who wanted
to be informed firsthand concerning the further de-
velopments of scientific-technical progress in this
area.

The Spring Fair at Leipzig has already for many years
played the role of a trend indicator for computer
technology; all significant new developments of our
EDP utilization had their starting point here. The
following trends, among others, could be delineated
for the 1982 Fair:

The present program of the VEB (State Enterprise) Combine Robotron,
beginning with office computers up to the RYAD-2-EDVA,
which were first presented in 1980 and 1981 respectively,
has been completed, expanded, and more rigorously
adjusted for the user. Determinative factors this time
were software solutions, where the particular hardware
represented only means to an end. - Application solutions
are being emphasized more from year to year.

Robotron Multicomputer System EC 1055/EC 1055M

The VEB Combine Robotron is constantly working on the development of newer data
processing technology and on variants of its effective utilization. An example
of this is the multicomputer system EC 1055/EC 1055M.

By coupling EC 1055 EDP systems, multicomputer systems can be formed, in which
the coupled central units always operate under the control of their own operating
system and with their own main storage. The level of a multicomputer system is
determined by the programming support of the existing devices and equipment.

The coupling of the systems can be implemented with the following technical
capabilities:

Channel-channel adapter
Direct signal control
Device control units with two-channel connection.

The equipment of individual EDP systems with peripheral units was minimized, for space reasons, to the extent necessary for the demonstration. Both computers were operated with the operating system OS/ES (Edition 6.1).

The demonstration of applications on the Robotron multicomputer system was performed by using the components MMS (multimachine support) of the operating system OS/ES. The interaction of two EDP systems was demonstrated by means of a prefabricated program packet PDV (program controlled file processing):

Starting from two files with statistical data, one file was built up through computer A. This file, whose structure was controlled by means of parameters, was transferred through the KKA to the computer B. There it was evaluated according to certain criteria desired by the interested party (parameter control), and the results were outputted on printed lists or were recorded on disk. The operator units record information concerning the collaboration of the computers. Furthermore, rapid data exchange between two main storage units, without the intermediate connection of peripheral devices, was also demonstrated.

In summary, the multicomputer system achieved the following advantages:

high performance capability with increased program throughput

increase of reliability against breakdowns of the computer system and thus high system availability

data exchange at a great speed through the channel-channel adapter

structure, management, and utilization of extensive data banks with constant availability through access from both computers to the same storage media

uniform loading of two computers and better utilization of system resources

facilitating the work organization with a simplification of the technological conditions in the computer system.
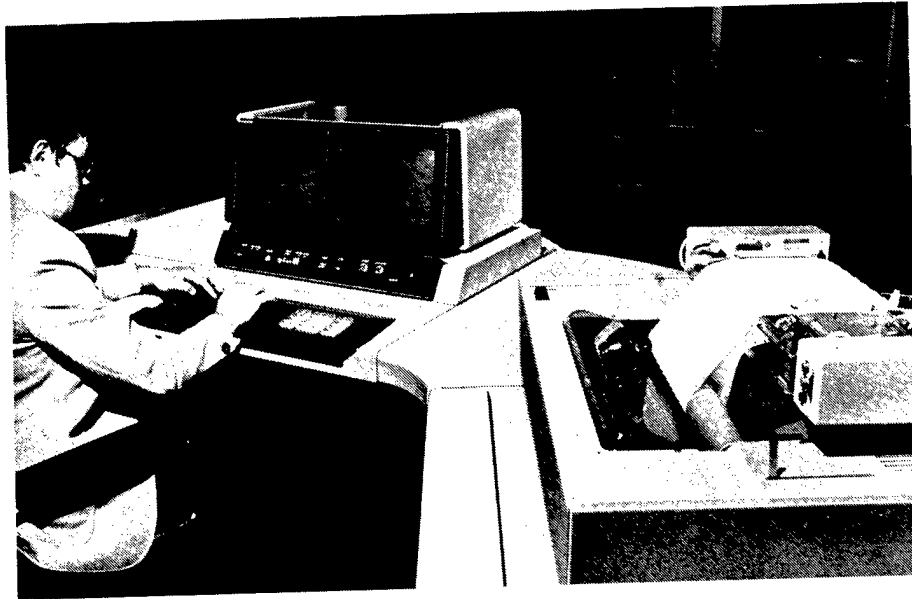
Operating and Service Processor EC 7069 and Printer 1154 in the
Multicomputer System EC 1055/EC 1055M
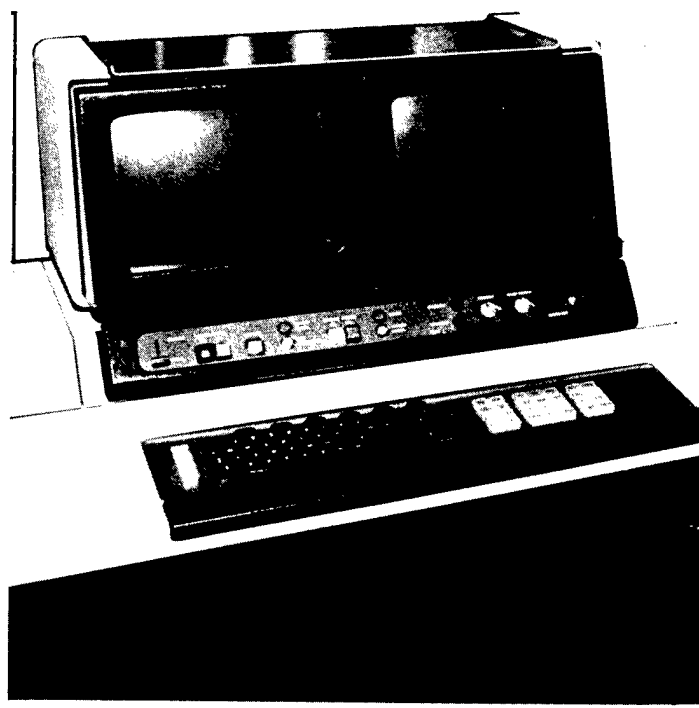
8348
CSO: 2302/4

EC 2655M CENTRAL UNIT FOR EC 1055M COMPUTER DESCRIBED

Performance Specifications

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 2, Feb 81
back cover

/Back cover series on "EDP Equipment," signed "MU": "EC 2655M Central Unit"] —

/Text/ EC 2655M is a central unit of the ESER (RYAD), series 2. It represents
a modernization of the EC 2655.

Technical Data:

Operating speed in thousands of operation per second (TOP/s)
   GIBSON-3 (single precision)   473
   GIBSON-3 (double precision)   425
   GPB-WU II   238

Instruction execution time in microseconds
Addition/subtraction, fixed point	0.93- 1.12
Addition/subtraction, floating point (single precision)	2.84- 3.64
Addition/subtraction, floating point (double precision)	3.04- 3.65
Multiplication, fixed point	7.26- 9.17
Multiplication, floating point (single precision)	6.29- 6.69
Multiplication, floating point (double precision)	9.54- 9.96
Division, fixed point	20.05-22.54
Division, floating point (single precision)	22.36-11.38
Division, floating point (double precision)	18.54-18.56
Transfer, unconditional	2.38- 2.39
Short operations	0.93- 2.64

Number of instructions   182

Main storage
Technical Base	16 K Bit dynamical RAM
Storage capacity in M bytes	1; 2; 3; 4
Calling width in bytes (quadruple overlap)	8
Cycle time in nanoseconds (ns)	600
ECC code	

Microprogram memory, loadable
  Technical basis   1 K Bit
  Storage capacity in K words   9
  Permanently programmed (K words)   8
  Freely programmable (K words)   1
  Word length in bits   66

Channels
  Maximum number   5
  Total data transmission rate in M byte/s   6.0-7.0

Byte multiplex channels
  Maximum number   2
  Maximum transmission rate in selector operation
  in k byte/s   1500
  Maximum transmission rate in multiplex operation
  in k byte/s   40
  Maximum number of subchannels   256

Block multiplex channels
  Maximum number   4
  Maximum transmission rate with 1-byte transmission
  in k byte/s   1500
  Maximum transmission rate with 2-byte transmission
  in k byte/s   3000
  Maximum number of subchannels   256

(Photo: EC 2655M Central Unit)

Installation data
  Number of cabinets   2
  Needed area in m^2 1.74
  Power consumption in kilowatts   4.1

Other function characteristics
  Virtual storage principle
  Connection for matrix module
  Basis program support
Furnishing the edition 6.1 of the OS/ES
System of virtual machines SVM/ES
expanded diagnostic means
  Microprogrammed control program support for the operating system SVM/ES (SVMA).

Description of EC 2655M Central Unit

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 2, Feb 81 pp 2-6

/Article by Wolfgang Lampenscherf, Dieter Linzmann, and Horst Otto, VEB Robotron _
ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 2655M Central Unit/

/Text/ The central unit EC 2655M is the further development of the central unit
EC 2655. The following functional units are new, where the remaining structure
and the functional principles were retained /1/:

Expanded main storage on a highly integrated circuit basis
New main storage adapter and key storage, matched to the new main storage
Loadable microprogram storage based on highly integrated circuits
New transformerless power supply from the mains in a modern design
Operation through an operating and service processor EC 7069M
Microprogrammed control program support for the operating system SVM/ES (SVMA).

These modernizations are characterized by the following data:

Increase of main storage capacity from 2 M bytes to 4 M bytes. The double main
storage capacity, in combination with a modern operating system, favors user
operation, increase of job throughput, and thus makes computer operation more
efficient. The mode of operation in the virtual storage concept and by stati-
cizing working files in main storage, relieves external storage media such as
e.g. moving head disks.

Reduction of the device volume and of the needed area, by using highly integrated
dynamical storage circuits with a capacity of 16 K bits, from the previous four
cabinets with a maximum main storage size of 2 M bytes to two cabinets for the
entire central unit including main storage, with simultaneous doubling of the
maximum main storage capacity to 4 M bytes. The required area of the CPU is
reduced from 3.7 m^2 to 1.74 m^2.

Loadable microprogram memory with a capacity of 8 K microinstructions for the
permanently programmed area in place of the previously used inductive ROM and a

significantly expanded storage capacity for the permanently programmed section of 1024 microinstruction as compared to the previous 32 microinstructions. The loadable microprogram memory permits rapid interchange between different versions of microinstruction sets. The expanded supplementary section and the expanded and accelerated loading possibilities through the CPU yield advantages for diagnostics.

Significantly reduced power consumption by using highly integrated circuit technology in the memories and by simplified switching networks with high efficiency, after the transformerless principle, from the previous 7.4 kW to about 4 kW. Another advantage in terms of applications is a reduced requirement for air conditioning.

In combination with the operating and service processor EC 7069M, significantly expanded and more flexible service possibilities in combination with loading capabilities for two floppy disk unit to load special service supports.

With the new internal functional principles of the operating and service processor 7069M, which works on a microprocessor basis, a novel solution is offered for the operating unit. In the following sections, the modernized and functional units will be briefly characterized.

1. Main Storage

Compared to the EC 2655, the main storage of the EC 2655M represents a further improvement as regards storage capcity, volume reduction, and power saving. This could be achieved by using 16 K-bit RAM storage circuits and by using proven technological and technical solution principles as well as by simplifying control sequences.

The maximum capacity of the main storage is 4 M bytes, where a separate access region was dispensed with. Because of the high degree of integration of the storage circuits, the entire capacity can be housed on two panels in the cabinet of the central processing unit (CPU), so that the storage cabinet as such could be omitted and consequently a complicated bus-line system with special cable drivers and receivers could be dispensed with. Dynamical 16 K-bit MOS circuits are used as storage circuits. These have a one-transistor cell as the basic element for storing one bit.

The 16384 storage cells of a storage circuit are formally arranged in 128 rows and 128 columns. To select the cell, 14 address bits are required, which are always offered to the circuit, as 7 address bits, in temporal sequence. This circuit then activates them.

Since dynamical RAM's are involved with the storage circuits, regeneration cycles are necessary to maintain the written information. In a regeneration cycle, all the cells of a row are regenerated, so that 128 regeneration cycles are necessary to regenerate 1 storage circuit. Each cell must be refreshed after 2 ms, which results in a spacing of about 15.6 µs between two regenerations. A regeneration counter monitors adherence to this time interval. For this purpose, it counts an appropriate number of timing cycles, and then initiates a regeneration request

which is reset after the regeneration has been completed. If the CPU does not execute any regeneration cycles, it delivers a release signal which permits regeneration. If no regeneration was possible within 15.6 MS, a gap for regenerating is forced by means of a blocking signal that is delivered by the main storage unit. The regenerations take place synchronously in time with the timing cycle scheme of the CPU, whereby simpler control sequences now result. For special test purposes, it is possible to vary the regeneration spacing.

Main storage has a capacity of 1, 2, 3, or 4 M bytes. On each of the above-mentioned two panels, the 36 bits of a word are stored. The implementation of the different main storage sizes is achieved by a different number of plug-in storage units, where this number is the same for each module, however. This is communicated to the CPU through special signals. The capacity of main storage with the minimum size (4 X 256 K bytes) is subdivided into a total of 12 storage plug-in units, where each module on each panel - that is twice altogether - requires a whole and a half plug-in unit. With the remaining expansion stages, the number of storage plug-in units multiplies correspondingly. Each plug-in unit has a capacity of 32 K bits in depth, with a calling width of 24 bits, which results in a minimum capacity of 256 K bytes per module, with a double word width of 72 bits. It is also possible to operate with 1, 2, 3, or 4 modules, where the modules can be started sequentially with an overlap at a spacing of 400 ns. The cycle time is 600 ns, so that, after two cycles, the same module can be called again or can be regenerated after 1.5 cycles. With overlapped 3- or 4-module operation, therefore, the regeneration cycles can therefore be performed in covered fashion.

No storage testing equipment has been provided for this storage unit.

2.   The Main Storage Adapter (MSAD)

The MSAD receives addresses and data from the users of main storage (CPU, central channel section, MAMO) and delivers the addresses and control signals necessary for main storage or in turn receives them from main storage. The MSAD appropriately forms the starting and address signals in dependence on the configuration and on the overlapped operation of the main storage modules.

When the configuration state is changed, the modules can be switched on and off. Module capacities of 256, 512, 768 K bytes or 1 M byte can be configured. The supplementary regions can be correspondingly configured for 16 and 32 K bytes.

The mode of operation with four modules is normally overlapped four-fold. Other operating modes have already been described in connection with main storage. The key memory was expanded to 2048 bytes, corresponding to the increased storage area of main storage. By using static 1-k bit RAM circuits, the space requirement for this memory was reduced from eight plug-in units to one.

The regeneration mode of main storage was simplified by the limitation to four modules which, however, are configurable as regards their size. The supplementary storage regions (16- or 32-K bytes respectively) are now situated at
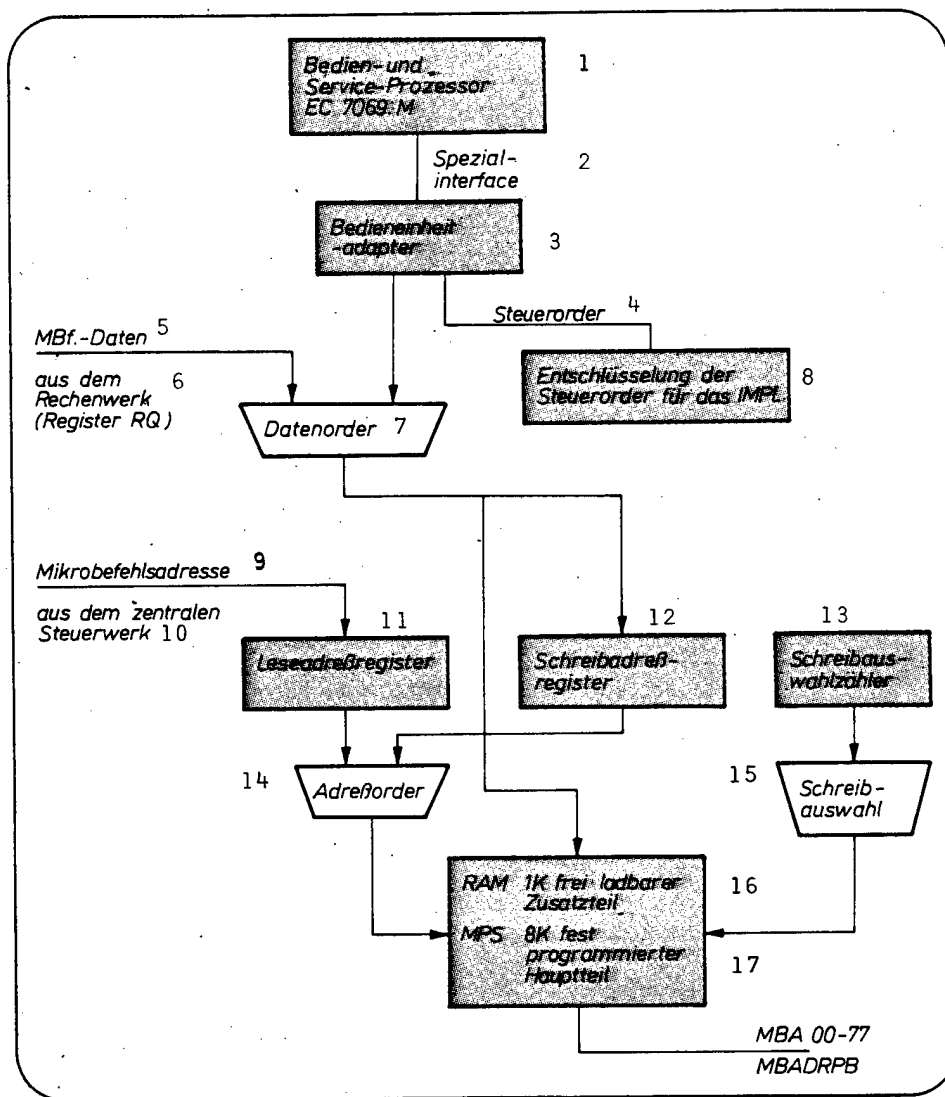
Figure 1: Coarse Structure of the Loadable Microprogram Memory

Key:

1. Operating and service processor EC 7069M
2. Special interface
3. Operating unit adapter
4. Control order
5. MBf data
6. From the computing unit (Register RQ)
7. Data order
8. Decoding the control order for the IMPL
9. Microinstruction address
10. From the central control unit
11. Read address register
12. Write address register
13. Write selection counter
14. Address order
15. Write selection
16. RAM 1K freely loadable supplementary section
17. MPS 8K permanently programmed main section

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the upper end of the physical address area of main storage. The diagnostic equipment of the CPU were appropriately adapted to the newly developed function groups.

3. Microprogram Storage

The MPS of the EC 2655M is a loadable MPS which is built up of 1 K X 1 bit static RAM elements. It replaces the ROM-MPS of the EC 2655 (word-organized inductive read-only memory). The RAM-MPS is housed in the panel 11D in place of the ROM-MPS. The capacity of the RAM-MPS is 9 K microinstructions with 66 bits each, whose format completely agrees with that of the EC 2655. The RAM-MPS consists of a permanently programmed main section (8 K microinstructions), which corresponds to the ROM-MPS of the EC 2655, and a freely loadable supplementary section (1 K microinstructions). With the EC 2655, the supplementary section has only 32 microinstructions.
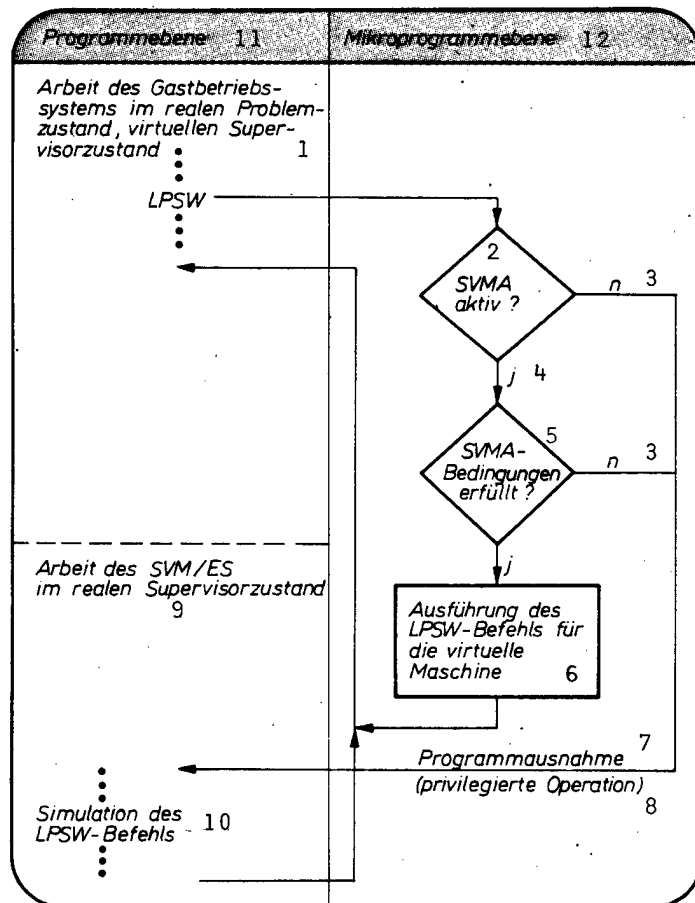
Figure 2: Mode of Operation of the Microprogrammed Control Program Support (Using as an Example an LPSW Instruction)

Key:
1. Operation of the guest operating system in the real problem status, virtual supervisor status
2. SVMA active?
3. No
4. Yes
5. SVMA conditions fulfilled?
6. Execution of the LPSW instruction for the virtual machine
7. Program exception
8. Privileged operation
9. Operation of the SVM/ES in the real supervisor status
10. Simulation of the LPSW instruction
11. Program level
12. Microprogram level

27
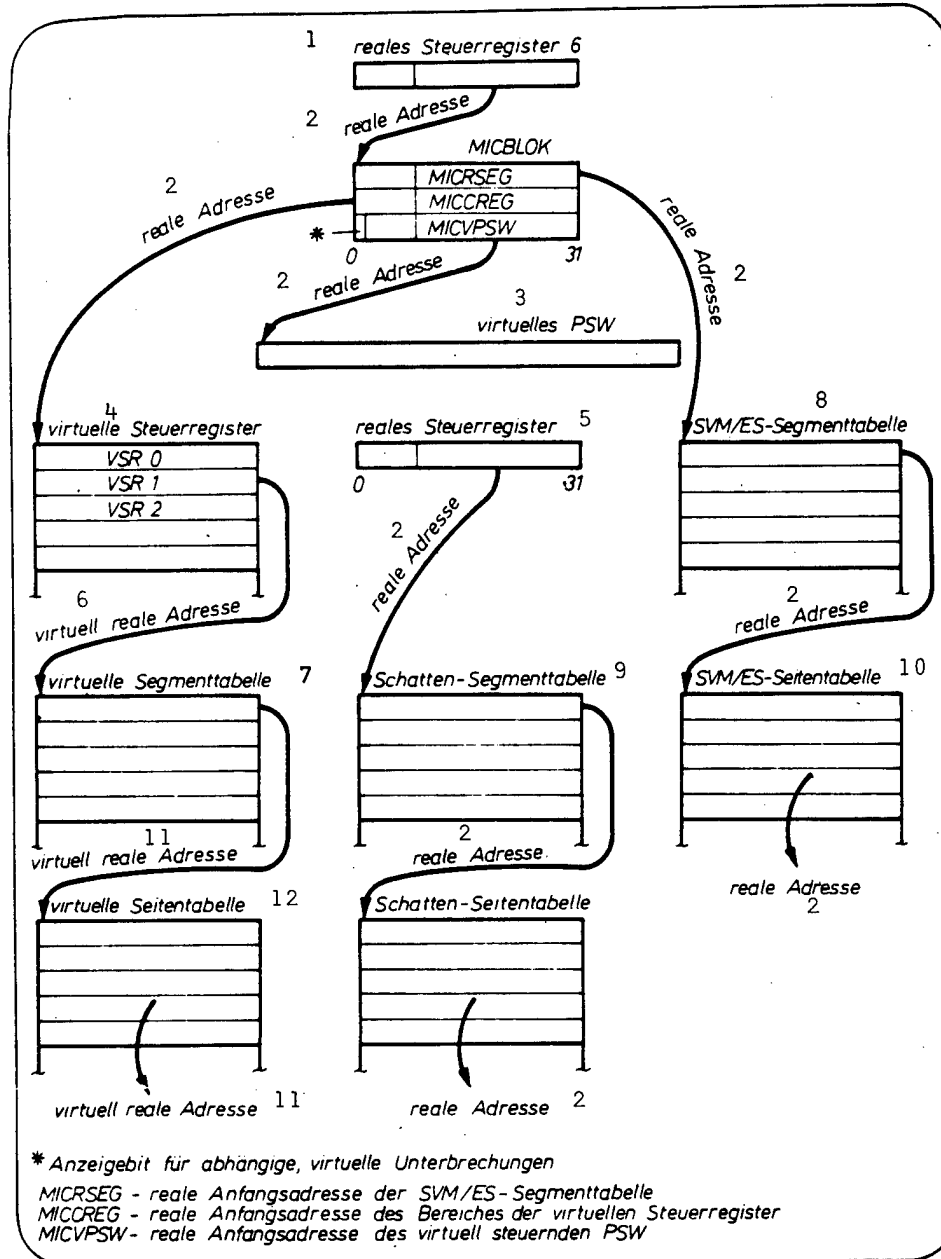
Figure 3: Control Data and Address Conversion Tables Used by the Microprogrammed Control Program Support (SVMA)

Key:
1. Real control register 6
2. Real address
3. Virtual PSW
4. Virtual control register
5. Real control register
6. Virtual real address
7. Virtual segment table
8. SVM/ES segment table
9. Shadow segment table
10. SVM/ES page table
11. Virtual real address
12. Virtual page table

*Indicator bit for dependent, virtual interrupts
MICRSEG - real starting address of the SVM/ES segment table
MICCREG - real starting address of the region of the virtual control register
MICVPSW - real starting address of the virtual controlling PSW

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When the data processing system is switched on, the microinstruction data must be stored in the RAM elements. These data are loaded from the BSP EC7069M via the special interface. The RAM-MPS loading is a new function of the BSP EC 7069M, the initial microprogram loading (IMPL). For this purpose, two new orders were defined at the special interface. The order E is intended for control purposes in connection with the IMPL. The order D always transmits one microinstruction byte. The IMPL can also be triggered by the EC 7069M via an operating picture.

There are two versions of microinstruction sets for the permanently programmed main section of the RAM-MPS. Both of these versions can be loaded:

SVMA
MAMO.

The version that is actually loaded depends on whether or not the MAMO is switched on. The RAM-MPS can be loaded not only through the IMPL but also through the CPU directly from the register RQ. The microstatement VR1 is used for this, and this statement is modified by bits 20 and 21 of the microinstruction. The RAM loading microprogram now makes possible both the loading of individual microinstructions and the loading of microinstruction blocks beginning at a certain starting address. Changing the RAM-MPS is equally possible in main storage and in the supplementary section. By means of the direct connection of the RAM-MPS with the register RQ, as well as by means of the capability of continuous loading beginning with a certain starting address, the loading rate of the CPU was raised considerably as compared to the EC 2655.

4. Power Supply

As with the EC 2655, the power supply is housed in cabinet 2 together with the associated control and monitoring equipment. But it represents a completely novel development. Transformerless switching circuits of an integrated construction type are used here.

5. Microprogrammed Control-Program Support

5.1 General Considerations

The control program of the SVM/ES makes it possible to operate several virtual machines with their associated operating systems and problem programs on one real data processing system (e.g. the EC 1055). For this purpose, the resources of the real data processing system are assigned by the SVM/ES to the individual virtual machines in a time-limited fashion. The technical device characteristics of a virtual machine can be set down in a specification. Although e.g. the real EDP system has available only one set of real control registers, several machines can use their own control registers. In this case one speaks of the virtual control registers of a virtual machine. Likewise, every virtual machine has a virtually controlling PSW. A special data block (VMBLOK) exists in main storage

for each virtual machine. This data block reflects the technical device properties of the virtual machine. During the time that a virtual machine is supposed to work, the SVM/ES activates the control information belonging to this particular virtual machine, i.e. staticizes this information in the real control equipment (e.g PSW).

The SVM/ES here changes the control information in such a fashion that it retains for itself control over the real device technology. If a virtual PSW e.g. indicates the supervisory status, the SVM/ES sets the problem status bit into the real PSW when this virtual PSW is activated. The machine then operates in the real problem status and in the virtual supervisory status. The virtual supervisory status is flagged in bit 1 of the control register 6. This makes certain that, while the virtual machine is operating, justified privileged instructions can be distinguished from unjustified ones (erroneously used ones). In the real supervisory status, only the control program of the SVM/ES can operate.

But for a few exceptions, the SVM/ES organizes operation with virtual machines in such a fashion that, from their point of view, the activity of the SVM/ES remains transparent. When processing time-dependent programs in a virtual machine, however, there are differences compared to their processing on a real EDP system that is exclusively assigned to these machines. With the introduction of the additional control level associated with the SVM/ES, the running time of the problem programs is affected. To keep this influence as small as possible, the microprogrammed control-program support (SVMA) was created. This support is especially important when an operating system, which operates with dynamic address conversion (control-program configuration SVS of the OC-6 EC), is supposed to run in a virtual machine under the control of SVM/ES. Since the SVM/ES always uses dynamical address conversion, a double address conversion is necessary in this case.

5.2 Purpose and Functional Scope of SVMA

SVMA consists of a number of new as well as modified microprograms and is used to speed up program processing under SVM/ES. The control program of the SVM/ES causes the guest operating systems (operating systems which run under the control of SVM/ES) to be activated in the real problem state. All privileged instructions which are executed while working on a virtual machine consequently generate program exception conditions which must be handled by the control program of the SVM/ES (simulated). If SVMA is present, the consequent high proportion of supervisory status time is reduced because SVMA can in many cases simulate the privileged operations for the virtual machines automatically. The control program of the SVM/ES must be called only in privileged operations, in which the simulation of the privileged operations cannot be achieved by SVMA (Figure 2).

Execution of the following privileged operations (in the real problem status) is supported by SVMA:

```
LRA    - Load real address
STCTL  - Store control register
RRB    - Reset access bit
ISK    - Insert storage key
SSK    - Set the storage key
IPK    - Insert protection key
SSM    - Set system mask
STNSM  - Store system mask and change conjunctively
STOSM  - Store system mask and change disjunctively
LPSW   - Load program status work
SPKA   - Set PSW protection key.
```

Furthermore, SVMA permits execution of SVC instructions (except SVC76) in the virtual machines, without SVM/ES having to activate the control program. An SVC interrupt for the particular actual virtual machine is here simulated on a microprogram basis.

Besides supporting privileged operations and SVC instructions, SVMA comprises a microprogram routine for handling page invalidity exceptions. By means of this routine, it is possible to avoid program interrupts as a consequence of page invalidity exceptions, if both the conversion tables of the guest operating system and also those of the SVM/ES control program contain valid entries. This achieves a further speed-up of program processing under SVM/ES.

If SVMA determines conditions which prohibit the microprogram implementation of the specified support functions, this will generally lead back to the respective normal functions, i.e. to program interrupts because of privileged operations, to SVC interrupts, and to program interrupts due to page invalidity exceptions. The operation of the CPU in the case of errors on the part of SVMA or if the SVMA has not been activated is here designated as a normal function.

5.3 Equipment Required by SVMA

Control register 6 is necessary for the operation of SVMA. This control register contains several control bits and the address of an address list which must be furnished by the control program of the SVM/ES. The following occupation holds for control register 6:

Bit 0 = 0 SVMA not activated
      = 1 SVMA activated
Bit 1 = 0 The virtual machine operates in the virtual supervisory status.
      = 1 The virtual machine operates in the virtual problem status.
Bit 2 = 0 Execution of ISK and SSK is permitted under SVMA.
      = 1 Execution of ISK and SSK is not permitted under SVMA.
Bit 3 = 0 All the specified privileged operations (corresponding to the
           instruction list of RYAD Series 2) may be supported by SVMA.
      = 1 Only the specified privileged operations which belong to the instruc-
           tion list of RYAD Series 1 (SUM, LPWS, ISK, SSK), may be supported
           by SVMA.

Bit 4 = 0 Execution of SVC instructions by SVMA is permitted.
      = 1 Execution of SVC instructions by SVMA is not permitted.
Bit 5 = 0 Handling the shadow tables by SVMA is not permitted.
      = 1 Handling the shadow tables by SVMA is permitted.

Bits 6 and 7 have no significance for SVMA.

Bits 8-31 contain the real address of an address list (MICBLOK) (bits 29-31 must be zero).

The specified address list (MICBLOK) begins at a double-word limit and contains three words. A real main storage address is stored in each word. The address in the first word represents a pointer to the real segment table of the SVM/ES. The address in the second word represents the pointer to the virtual control registers, while the address in the third word indicates the real main storage location at which the virtual controlling PSW begins (Figure 3).

Bit 0 of the third MICBLOK word is furthermore used as an indicator bit. If this bit equals 1, a virtual interrupt request follows. Both control register 6 and the MICBLOK are read by SVMA but are not changed. (An exception is bit 1 of control register 6 in the case of the LPSW instruction.)

5.4 Activation and Mode of Operation of SVMA

After the required control information in the MICBLOK as well as in the respective system regions (virtual control registers, virtual PSW, address conversion tables) has been furnished, the operation of SVMA can be activated by loading control register 6 with a suitable control word. A necessary presupposition for the operation of SVMA furthermore is the real problem status in the active PSW. During the real supervisory status and also while the LEX mode is switched on (concerns DOS/ES emulation), SVMA is not functional.

If SVMA has been activated, execution of one of the specified privileged operations in the real problem status does not directly entail a program interrupt (privileged operation). First, further conditions are tested which must be fulfilled for the execution of the respective operation with SVMA. Among these also belongs a check of the associated control bits in control register 6, interrogation of the LEX mode, and testing of the MICBLOK address in control register 6 with respect to adherence to the double-word limit requirement. If one of the above conditions is not fulfilled, SVMA terminates its activity for this operation and a program exception (privileged operation) is reported. The further execution sequence occurs as if SVMA were not present. If the above conditions are all fulfilled, the instruction is executed according to the SVMA specification. In accord with this specification, further exception conditions can here be recognized, which likewise entail the report of a program exception (privileged operation). In some cases, access exceptions are also recognized and reported. No distinction is here made whether the access exception has occurred because of an error in the SVM/ES or because of an error caused by the programs of the virtual machine. In every case, an interrupt occurs with

transfer of control to the SVM/ES. An exception to this are page invalidity exceptions which, in certain cases, first continue to be handled by the SVMA. For non-privileged operations (except SVC), support from SVMA in principle exists only if page invalidity exceptions occur. This support, however, is bound to the use of dynamical address conversion in the virtual machine (EC and DAT bit equal to one in the virtually controlling PSW).

With the SVM/ES, the available real storage is divided according to the requirements of the virtual machine. For this purpose, SVM/ES structures the storage into 64-K segments, each with 16 4-K pages.

An operating system which runs in the BC mode in a virtual machine consequently is thus also subject to the dynamical address conversion introduced by SVM/ES.

This process is transparent for the guest operating system.

Page invalidity exceptions which may occur thereby are not supported by SVMA, but are fed to SVM/ES and are handled in well-known fashion. If the operating system in the virtual machine works with dynamical address conversion, a double address conversion becomes necessary since the addresses which are real from the point of view of the guest operating system (designated as virtual real addresses) must still be converted through the tables of the SVM/ES. This double address conversion is supported by SVMA. So-called shadow tables are furnished for this by SVM/ES. The formatting of the shadow tables corresponds to the formatting which obtains for the conversion tables of the guest operating system. All combinations of 1-M byte or respectively 64-K segments as well as 4-K and respectively 2-K pages are possible here. If a page invalidity exception occurs, SVMA attempts the double address conversion and, if the conversion is successful, an entry is made in the shadow page tables. The interrupted instruction is then repeated automatically. In this fashion, the logical addresses used in the virtual machines are associated with the real addresses of the main storage unit, through the shadow tables. This association is also staticized in the TLB when the logical addresses are used. If the required double address conversion cannot be implemented by SVMA, the original page invalidity interrupt is handled completely in the usual fashion, and control is transferred to SVM/ES. The shadow tables are the active tables which are used by the address conversion equipment. The shadow segment table starting address is situated in the real control register 1.

Accordingly, three address conversion table sets belong to a virtual machine in which an operating system is operating with dynamical address conversion:

Conversion tables of the guest operating system
Conversion tables of the control program of SVM/ES
Shadow tables (Figure 3).

When working with virtual machines under the control of SVM/ES, processing is faster by a factor of two if SVMA is used, than if SVMA is not used.

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EC 7069M CONSOLE, SERVICE PROCESSOR FOR EC 1055M DESCRIBED

/Article by Heinz Voigtlaender, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 7069M Console and Service Processor"/

/Text/ The operating and service process (BSP) EC 7069M is a successor and further development of the operating unit (BE) EC 7069. The purpose of the BSP is to guarantee not only the systems servicing of ESER (RYAD) systems (communication between the operator and the operating system) but also maintenance servicing (communication between the maintenance engineers and the device technology). Its further function is to control initialization of the central unit (CPU) (monitoring main power switch on, loading of microprogram memory), and extensive support during service, in diagnostics, and in operating the EDP system. Thus, the functional scope and servicing convenience are significantly expanded as compared to the BE.

The possibility basically exists of connecting the BSP to other CPU's of Series 1 and 2 of RYAD, inasmuch as these accept the serial special interface (SPIF).

The BSP EC 7069M is an autonomous unit equipped with standardized connections and thus can be set up at a location that is optimal for servicing the EDP system. The length of the connection cable between the CPU and the BSP may be at most 60 meters.

As an input/output (I/O) unit, the BSP operates in two different and mutually exclusive operating modes which can be selected by the operator and which are designated as

Typrewriter operation mode (SM) and respectively
Display screen/printer operation mode (DM).

1. Basic Structure

The BSP EC 7069M is a sit-down work station and comprises the following equipment:

    Electronics complex
    Two display screens (monitors)

Operating panel
Power supply
Two floppy disk drives
Standard interface connection (SIF)
Special interface connection (SPIF)
Power supply-control-interface and system control-interface connection
Means for maintenance and diagnostic purposes
Means for acoustic signaling
Clock
Printer.

2. The Modular Principle (Figure 1)

The electronics of the BSP represents a modular multi-microprocessor system.
All subassemblies are connected, in the form of modules, to an internal universal
bus. In this way, it is possible to replace individual modules, to add them, or
to omit them, without this requiring significant changes of the entire apparatus.
This universal bus, with its characteristics, makes possible the following:

> The data transmission can be executed between arbitrary connected devices
> according to the Master-Slave Principle

> Every connected device can in principle act either as a master or a slave

> Data are transmitted byte-parallel

> The data rate in multiplex operation is about 300 k bytes per second

> For special cases one can work in the burst mode, where a higher data rate
> can be attained.

The 20 address lines make available an address space of 1 M byte. Special lines
and transmission procedures are provided for internal diagnostics and for
maintenance and troubleshooting purposes.

3. Function Complexes and Modules

As already explained, the BSP uses a modular structure which is further supported
by the new circuit board technology.

The entire logic is subdivided into function complexes (Figure 1) and further
adapters. Each function complex is housed on a 390 X 270 mm circuit board.
By adapters are also understood the circuit boards with cable stages for the
SIF and SPIF. They are used to adapt the particular connection pictures of the
units (e.g. floppy disk drives, printer) to the connection conditions of the
function complexes.

The bus control has the following tasks:

> Transmission of bus requests
> Triggering of bus cycles
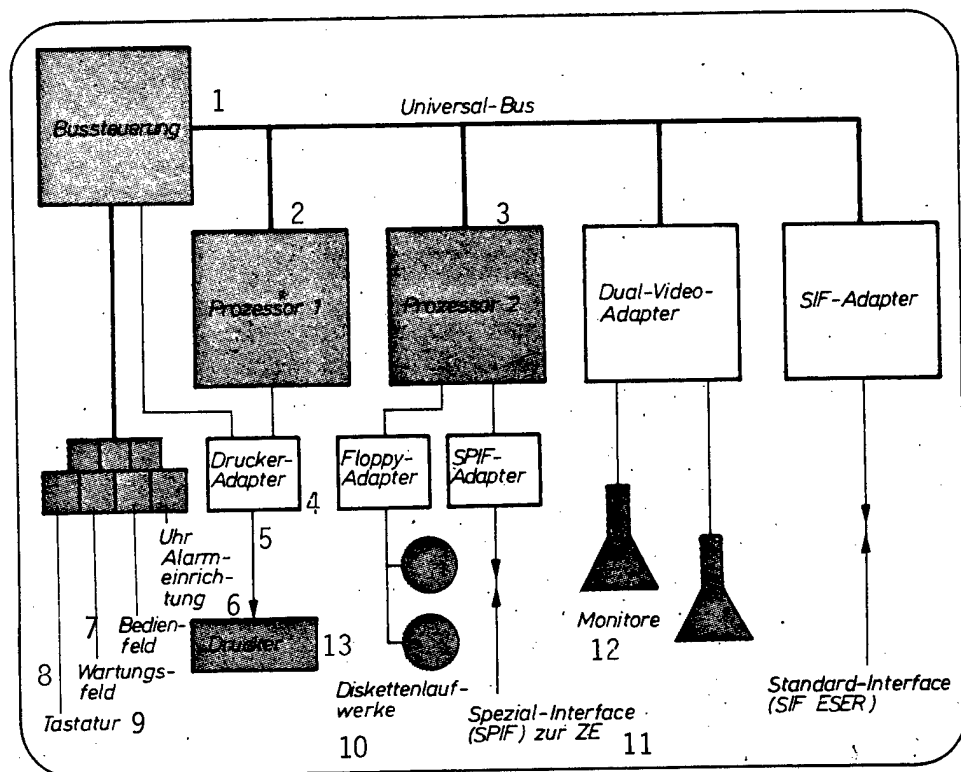
Figure 1: Modular Structure of the Operating and Service Processor
        (BSP) EC 7069M

Key:
1. Bus control
2. Processor 1
3. Processor 2
4. Printer adapter
5. Clock

6. Alarm device
7. Operating panel
8. Maintenance panel
9. Keyboard
10. Floppy disk drives

11. Special interface (SPIF)
    to the CPU
12. Monitors
13. Printer

    Checking the execution of bus cycles
    Handling hardware errors
    Execution of maintenance functions
    Execution of service functions which are requested by other complexes
    (e.g. setting and interrogating the clock, emitting acoustic signals).

The ROM memory of the bus control comprises 9 K bytes, and in it are stored the
microprograms necessary for this complex of functions.

The processor (SBC/32 K) is a compact microcomputer with a storage capacity of
32 K bytes. Just as with the bus control, microprograms are stored in a 4 K ROM
memory, where these microprograms are also used for the internal diagnostics of
the processor.

The 32-K byte RAM memory permits parity tests and a comparison-stop operating mode for maintenance and program testing. A storage protection device is also provided.

A processor generally has two tasks:

Processing the BSP-internal programs
Controlling peripheral equipment (printer, floppy disk drives, SPIF).

Usually, the distribution of task is organized in such a fashion that, after the system has been established, the processor processes the internal programs in its basic state and the peripheral control is activated through interrupts.

The Dual Video Adapter (DVIA) provides the deflection, synchronization, and video signals for the independent control of two monitors. Twenty-four lines with 80 characters each are always shown on each display screen. A picture memory for eight pictures (16 K bytes and additionally 16 K bits for the cursor display) is provided for each display screen. This memory can store not only alphanumeric characters but also field-control characters, so as to control the display on the screen.

A field-control character is a non-display character with a subsequent field-control action on the following alphanumeric characters until the next field-control character.

Up to 128 characters can be stored in the character generator.

The mode of representation of the cursor can be set by the program for each of the two display screens. Thus, it can be represented as

a simple underline
a blinking, very bright underline
an inverse, blinking representation of the entire relevant character position.

The standard interface adapter makes possible a connection to the SIF ESER (RYAD). Data-, status-, sense-, and control-registers are provided for the independent operation of maximally eight units of the BSP. It is possible to connect to all channel types of RYAD, i.e. the BSP can be connected to the byte multiplex-, selector-, or block multiplex-channel.

The remaining modules are connected to these four function complexes, which have been presented briefly here, either directly or through the adapters. As can be seen from Figure 1, two processors are used in the BSP.

The keyboard is directly connected to the bus control. The keyboard arrangement corresponds to the keyboard EC 0101-1, which was previously used in RYAD units. In addition, a keyboard group has been provided, which contains elements to operate the connected CPU.

Another six variable function keys, whose significance is always explained in the 24th line of the right display screen, are situated above the alphanumeric keyboard complex.

In principle, two different keyboards are provided:

Latin Keyboard:
This allows the input of Latin upper case and lower case letters, numbers, and special characters.

Cyrillic-Latin Keyboard:
In this design, it is possible to input Cyrillic and Latin capitals, numbers, and special characters.

An interchange is possible at any time without great effort. Regardless of the design of the keyboard, all keys which initiate control-, erase-, and program-functions have the same lettering and in particular in accord with the abbreviations customary in the operating system.

The maintenance panel and the clock are likewise connected directly to the bus control. As was already the case with the EC 7069, the maintenance panel is affixed in covered fashion. But it contains only a minimum number of operating elements. The maintenance functions are generally exercised, with the BSP, through the keyboard and the display screen. Thus, the maintenance panel contains only

the changeover switch for the entire operating mode
the keys for triggering the initial microprogram loading and for test functions
the error indicators for the logic and the power supply
the changeover switch exchanging the display screen displays.

The clock is quartz-controlled and is buffered through a battery, so that even when the BSP is switched off, the clock continues to run. On the display screen, the hours and minutes are in principle represented as digits, and the seconds as a blinking dot. In the switched-off state of the BSP, there is consequently no display. The clock time and the time can be stored through an internal control of the BSP. This can be useful, for example, when error messages, detected power-line disturbances, or other important events are to be recorded on the working floppy disk for subsequent evaluation.

The operating panel is connected partly with the bus control but partly to the CPU, directly through the system power supply interface.

It is situated below the monitors and comprises

the emergency switch for the entire EDP system

the operating and indicator elements of the central power supply control with the associated key switch

the key switch for ON-OFF-LINE

the key switch to allow or prohibit the CPU maintenance functions

the indicator elements for "OFF-LINE", "NOT CONNECTED", "DEVICE CHECK".

The series printer Robotron 1154 with continuous fan-fold equipment Robotron 1160 has been provided as the printer.

Its printing speed is as follows:

$\leq$ 45 characters per second during continuous operation or respectively
$\leq$ 25 characters per second during start-stop operation.

The maximum writing width is 132 characters and the printable characters comprise

26 upper case letters Latin
31 upper case letters Cyrillic
10 numbers and
25 special characters.

The floppy disk drives EC 5074-01 are mainly used to load the microprograms of the BSP and of the connected CPU. The two drives can be used alternatively. Through a special maintenance mode, it is also possible to write on the floppy disks through the SIF RYAD. The storage capacity of these disks is about 300 K bytes per disk.

A possibility is provided to double the floppy disks. The power supply of the BSP, including a special monitoring and control section, is housed in a panel.

This monitoring and control section guarantees the proper switch-on and switch-off as well as the tolerance monitoring of the various logic voltages. When the BSP is switched off because one of these tolerances has been exceeded, or because of other faults of the operating voltages, special circuit measures guarantee that the fault display remains preserved.

The special interface (SPIF) of the BSP is the same as that of the BE EC 7069. Thus the BSP can also be connected to the EC 2655.

4. Functional Aspects

With the use of two monitors, it is possible simultaneously to display 3,840 characters on the display screen. It is thus possible to display simultaneously information which should be accessible directly and without change of picture, and to structure this display in a clear form.

Switches which are situated on the maintenance panel can interchange the information that is displayed on the display screen, i.e. the right display screen will now display the information of the left one and vice versa. This has the great advantage that, even if one monitor breaks down, one can continue working without

restriction since, now as before, all the pictures can still be displayed. The organization of the display screens will be explained below, starting from the basic position:

Left Display Screen

This display screen is accessible under a device address (depending on the configuration in the display screen/printer- or typewriter-mode).

Here, all 24 lines are available for the program picture. By activating keys, one can cause the picture to change to operating and display pictures (similar to the EC 7069), or one can cause a return to the program picture.

Right Display Screen, Upper 12 Lines

This region is accessible under a second device address in the typewriter-mode.

Alternatively, the following are shown in this region:

    Internal maintenance and auxiliary information of the BSP (maintenance mode)
    The configuration picture (in the "OFF-LINE" state)
    Operating pictures for CPU access (HS displays and the like).

Right Display Screen, Lower 12 Lines

This region has a fixed format. It is used to represent the following complexes:

    Interpretation of the "variable function keys"
    Status of the keyboard
    Time of day
    Status of the units (display screens, printer, etc.)
    Internal error messages
    Conditions in the connected CPU.

The keyboard is switched over between the two monitors by control keys. The cursor display indicates the monitor to which the keyboard has been assigned.

The configuration of the BSP at the SIF RYAD can be set in the "OFF-LINE" state through the configuration picture. The configuration can be independently adjusted for the two monitors and the printers. With the configuration input, unallowable configurations are detected and are rejected.

When transferring from "OFF-LINE" into the status "ON-LINE" or upon special keyboard request, the configuration is stored on the floppy disk.

This configuration, which is stored on the floppy disk, is automatically set up again and the BSP is switched on, after loading the microprograms.

The confiration possibilities are presented below:

Left Monitor
    OFF-LINE
    Display screen/printer mode
    Typewriter mode

Right Monitor, Upper 12 Lines
    OFF-LINE
    Typewriter model with 12 lines, 80 characters each

Printer
    OFF-LINE
    Buffered mode (1,920 characters print buffer)
    Unbuffered model (corresponds to the display screen/printer mode printer with
    EC 7069)
    Typewriter mode, left monitor
    Typewriter mode, right monitor.

In the typewriter-mode operating mode, the printer is assigned to the respective
display screen. But this configuration is accepted only when the corresponding
monitor is likewise in the typewriter operating mode.

If such is not the case, the configuration is rejected.

A special organization is the basis for the formatting of the floppy disks that
are used as data media. This organization makes possible optimal utilization of
the storage capacity. Consequently, only one floppy disk is needed for the
microprograms of the EC 2655M and the MAMO.

The character inventory which can be processed by the BSP comprises the complete
RYAD system alphabet, i.e.

    Latin upper case and lower case letters
    Cyrillic upper case letters
    Numbers and special characters.

Coming from the I/O channel, all characters contained in the system alphabet are
accepted.

Lower case letters are represented on the printer in principle as upper case
letters. This is not the case, however, in the display screen representation.
Here, the BSP offers the possibility, by further configuration control, of
displaying

    only upper case letters analogous to the printer
    Latin upper case and lower case letters
    Cyrillic upper case letters
    and the numbers and special characters.

The transmission to the channel takes place in the mode of the particular infor-
mation representation.

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An extensive system of test routines is available for the internal diagnostics of the BSP. At the same time, a maintenance system has also been implemented, which makes it possible for the engineer to obtain information concerning the status of the BSP as well as its preceding history, and to test the device terminals extensively. The following means are provided for hardware trouble-shooting, that is the localization of defects in a faulty BSP:

Circuit measures in the logic circuitry for using the character evaluation ROM-resident test routines
Plug-in diagnostic adapter for elementary test runs
Direct indication of hard errors on the maintenance panel and, where appropriate, acoustic alarms.

Besides the ROM-resident test routines, further programs can be loaded from the floppy disks.

The modular organization of the logic circuitry and the internal test precautions on the individual function complexes results in further facilitations.

To control the diagnostic process, the operating panel is primarily used in combination with the keyboard and the display screen.

Advantages of the Operating and Service Processor EC 7069M as Compared to the Operating Unit EC 7069

The modular multi-microprocessor structure, the available RAM storage capacity of maximally 96 K bytes, and the use of two floppy disk drives permit a very flexible deployment. Adaptation to the variable requirements of the CPU is thus possible.

Extensions or adaptation to other CPU's of the RYAD can be effected by adding or exchanging functional complexes or modifying the microprograms.

Due to the use of two monitors, there are significant advantages especially in terms of operation:

The individual pictures are designed more clearly and more informatively.
The displays are presented in clear text or in intelligible mnemonics;

Clarity is improved. More information can be displayed at the same time. In particular, the possibility is utilized of showing extensive information concerning the CPU simultaneously with the displayed program picture (e.g. display of conditions, instruction counter hours, settings of the address comparison stop equipment, etc.);

The system messages can be divided between two independent regions;

The internal maintenance functions can be executed through the display screen and keyboards;

If one monitor breaks down, work can continue without significant down time; in particular, the scope of the displayed information remains intact through appropriate measures.

The more extensive diagnostic and maintenance measures as well as precautions for utilizing character evaluation in case of a fault guarantee more efficient troubleshooting and thus shorter down times.

When producing a hard copy, i.e. printing out a display picture, it is possible at any time to determine the beginning and end of the copy through the cursor position or by depressing a key. In many cases, this results in considerable time savings.

The clock offers not only the advantage that, when the EDP system is switched on, or when beginning a new program, the clock time can be interrogated by simply depressing a key and can be transmitted to the CPU, but also offers the possibility of storing in the floppy disk error information together with the clock time, for subsequent evaluation.

Reliability has been significantly increased.

Operating and Service Processor EC 7069M, Plant Photo
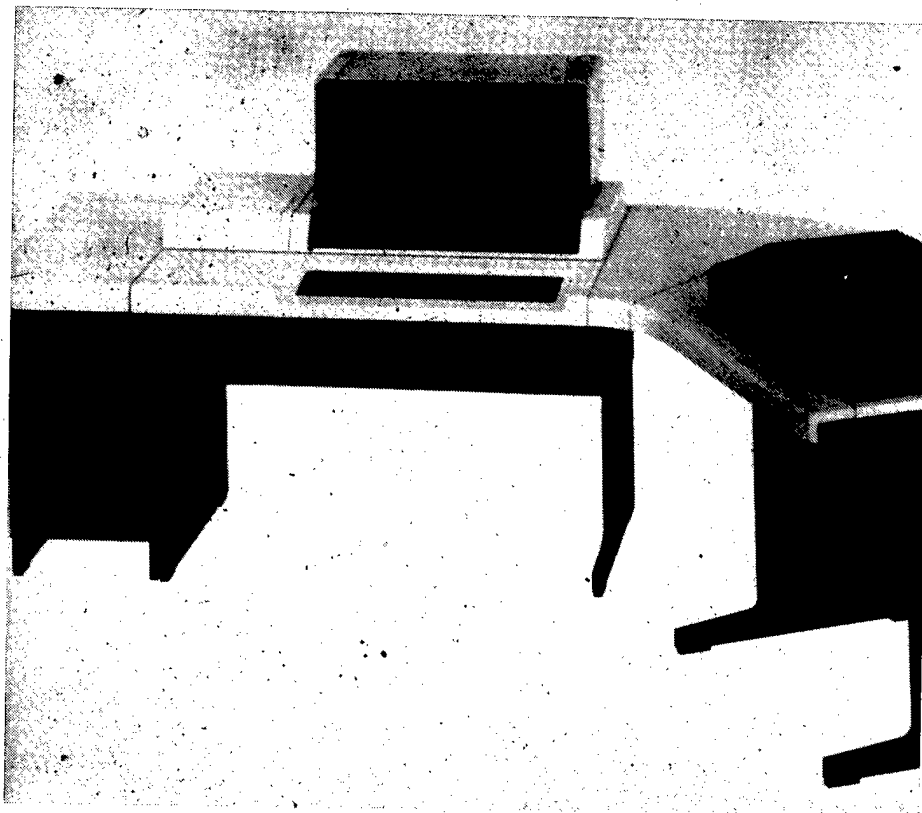
Operating and Service Processor EC 7069M, Plant Photo

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EC 7920M DISPLAY SYSTEM FOR EC 1055M COMPUTER DESCRIBED

Description of System

[Article by Dr Peter Anke, VEB Robotron ZFT (Center for Research and Technology),
Karl-Marx-Stadt: "EC 7920M Display Systems"]

[Text] The display screen system EC 7920M is an alphanumeric communication system
with applications in many areas of the national economy. Application opportunities
exist especially in the area of data acquisition and for tasks which can be accom-
plished only in conversational mode with an EDP system. The display screen system
EC 7920M consists of a display screen unit EC 7927.01, the printer EC 7934.01M,
the display screen station 7925.01M, and the device control units EC 7927.01M
(remote connection) as well as EC 7922.01M (local connection). The display screen
unit and the printer have the same separation point for connection to one of the
device control units through a single-stranded coaxial cable with a maximum length
of 1200 m. Up to 32 display screen units and/or printers can be connected to one
device control unit. For start-up and for testing the system configuration,
it is necessary to connect a display screen unit. The remaining 31 connections can
be occupied in an arbitrary configuration. All devices of the display screen system
7920M have available a buffer memory of 1920 characters. As regards the connection
of the EC 7920M to an EDP system of the ESER (RYAD), one basically distinguishes
three configurations: the local display screen system EC 7020.01M, the remote dis-
play screen EC 7920.11M, and the remote display screen station EC 7925.01M. Figure
1 shows the universal connection possibilities.

1   selection pencil
2   keyboard
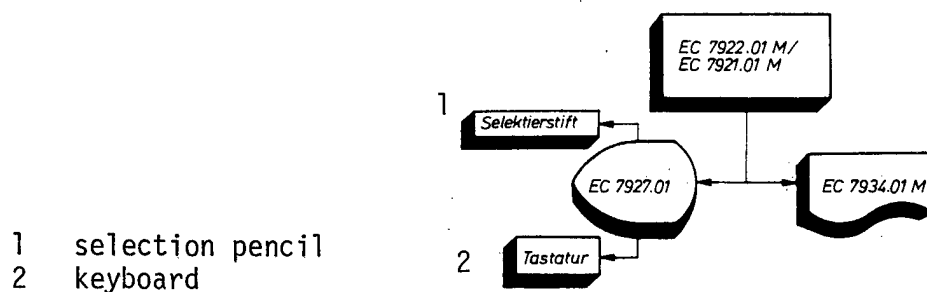
1. System Description of the Display Screen System EC 7920M

1.1 Field Concept

Information consists of a number of independent data elements. Each of these data
elements has its own characteristics, which determines the further processing.

With previous display screen systems of RYAD, the information was exchanged for data
sets, whose contents and characteristics corresponded to the capabilities of the
data processing system. Data elements thus could be transmitted not individually
but only as components of a data set. This entailed considerable redundancy in
data transmission.

In contrast to this, the display screen system EC 7920M takes into account the
handling of individual data elements, which henceforth will be designated as fields.
This becomes possible since each of these data elements is defined by the content,
length, and position within the entire information that is to be exchanged, that
is it has its own characteristics. User operation with individual fields permits
data transmission to be restricted to the absolutely necessary fields and thus sig-
nificantly increases efficiency and facilitates operation by using tabular input
directives. As a result, input reliability is also improved.

A field is delimited by two so-called attribute symbols. The introductory attribute
symbol determines the characteristic of the associated field.

Besides the length, which is specified by the position of the attribute symbol, the
code of the attribute system can specify the following additional properties of the
associated field:

Protected or unprotected

If the field is protected, the operator cannot change its content. Protected fields
are, for example, headings, formats, titles, requests to the operator for input.
All those fields are specified as unprotected which are provided for inputting or
changing information by the operator. These are also called input fields.

Alphanumeric or numeric

All letters, numbers, and special characters can be inputted in an alphanumeric
field. With a numeric field, a numeric keyboard interlock automatically limits the
assortment of characters that can be inputted.

Not displayable and not printable, displayable with normal brightness and printable,
and displayable with intense brightness and printable

The specification "not displayable and not printable" is used when data should not
be displayed on generally visible display screens or should not be printed on
printers for reasons of secrecy.

A more intense brightness is necessary to emphasize important information or to
call attention to an error condition.

Selectable with the selection pencil or not

Selectability of a field with the selection pencil greatly facilitates operation. From a large number of prescribed alternative responses, one or more can be prepared for transmission to the EDP system merely by touching with the selection pencil.

Selected or not selected for transmission to the EDP system

A field counts as "selected for transmission to the EDP system" if data are inputted into the field by the operator or if the field data have been changed. This selection is achieved by touching a selectable field with the selection pencil. Prepared input data are characterized in the attribute symbol by the so-called MDT bit. Subsequently, only those fields are transmitted to the EDP system whose MDT bit has been set to "1" by this preselection.

The attribute symbols can be transmitted only by write commands from the EDP system to the display screen. They are not displayed or printed and cannot be changed by keyboard inputs and by the selection pencil. The MDT bit is an exception.

If a display screen display is divided into various fields by the attribute symbols, this display is called formatted.

In the case of an unformatted display, the positions on the display screen can be chosen freely. This corresponds to the mode of operation with display screen units that have previously been used in RYAD.

1.2   Display Screen Unit EC 7927.01

1.2.1 Display Screen Display

The display format of the display screen unit EC 7927.01 is 24 lines with 80 characters each, corresponding to the capacity of the buffer memory. The alphanumeric characters generated by the keyboard or by the problem program can be displayed within unformatted or formatted (field concept) displays. The data input of the operator is supported with a position mark, the cursor, which is shown on the display screen. The cursor is represented by a blinking line underneath the character position, into which the next character is to be inputted through the keyboard.

It is possible to position the cursor through the cursor control keys or through the problem program.

1.2.2 Status Indicators

To check the data input and the communication with the EDP system, the display screen unit has four status indicators.

The switched on indicator SYSTEM AVAILABLE provides information concerning the availability of the system for a new data input.

The indicator INPUT BLOCKED is switched on if data input is blocked through all input devices.

If the display screen unit is put into the "insertion" mode through the keyboard, the indicator INSERTION MODE is switched on.

Fault conditions in the power supply are indicated by DAMAGE.

1.2.3 Keyboard

Four keyboards can optionally be connected to one display screen unit:

Operator station keyboard EC 0101-1.01

This consists of an alphanumeric keyboard (Cyrillic and Latin alphabet) with function keys, and of a block of 12 program function keys.

Data acquisition keyboard EC 0101-1.02

This is composed of an alphanumeric keyboard (Cyrillic and Latin alphabet) with function keys, five program function keys, and one digital keyboard block.

Typewriter keyboard EC 0101-1.03

This consists of an alphanumeric keyboard (Cyrillic alphabet) with function keys and of a keyblock with 12 program function keys.

Latin keyboard EC 0101-1.04

This is composed of an alphanumeric keyboard (Latin alphabet) with function keys, and of a keyblock with a digital keyboard, combined with 12 program function keys.

The Latin keyboard has lower case letters in the upper position and the typewriter keyboard has lower case letters in the lower position. By activating the change-over keys сБ and срcБ, the operator station keyboard and the data acquisition keyboard can also input lower case letters.

The following description of the most important keyboard functions is based on the Latin keyboard EC 0101-1.04 (Figure 2).

Alphanumeric Keys

Depending on the changeover keys, the alphanumeric keys are used to input upper case and lower case letters, digits, and special characters. The inputted characters are displayed at the cursor position. The cursor is then moved ahead in the writing direction by one position. After the next to last position in the display screen display has been inputted, an acoustic signal will sound.

Program Attention Keys

The activation of every program attention key causes an input search (henceforth called an I/O message). The differences between these keyboards are coded in the message

identification symbol (AID). The AID is a component of the message that is being transmitted to the EDP system.

The transmission of the data which have been inputted by the operator is reported by means of the "input" (ENTER) key. The program function keys PF1 and PF12 act like the "input" key. However, here it is possible to provide additional information to the problem program by the key-specific coding of the AID. For example, inputted data can be made available to purposefully selected program sections for evaluation.
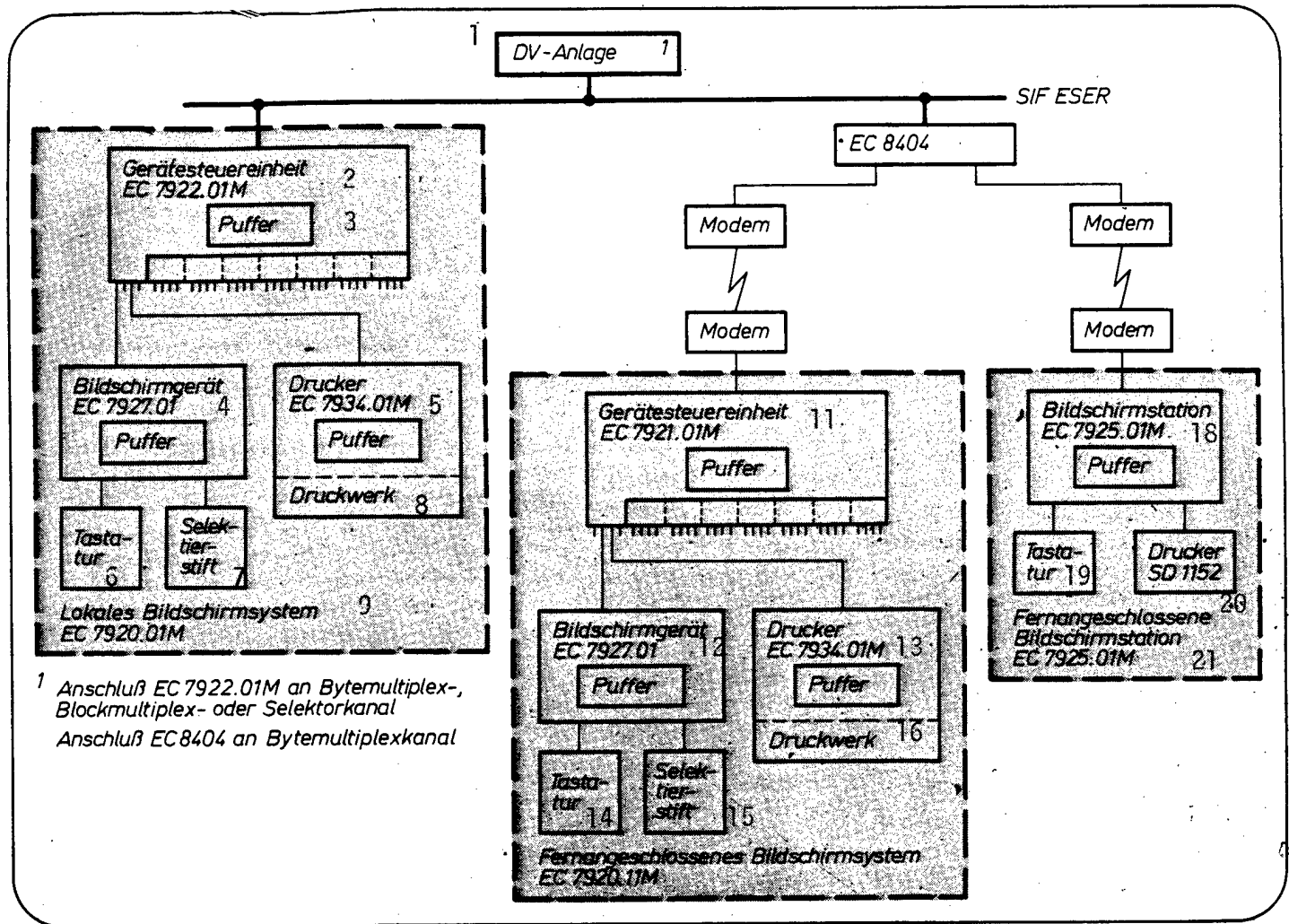
Figure 1. Connection possibilities of the display screen system EC 7920M

Figure 1 - key

1   EDP system[1]
2   device control system EC 7922.01M
3   buffer
4   display screen unit EC7927.01
5   printer EC 7934.01M
6   keyboard
7   selection pencil
8   print mechanism
9   local display screen system EC 7920.01M
10 SIF RYAD
11 device control unit EC 7921.01M
12 display screen unit EC 7927.01
13 printer EC 7934.01M
14 keyboard
15 selection pencil
16 print mechanism
17 remote connected display screen system EC 7920.11M
18 display screen station EC 7925.01M
19 keyboard
20 printer SD 1152
21 remote display screen station EC 7925.01M

[1] EC 7922.01M connected through a byte multiplexer or selector channel
    EC 8404 connected through a byte multiplexer channel
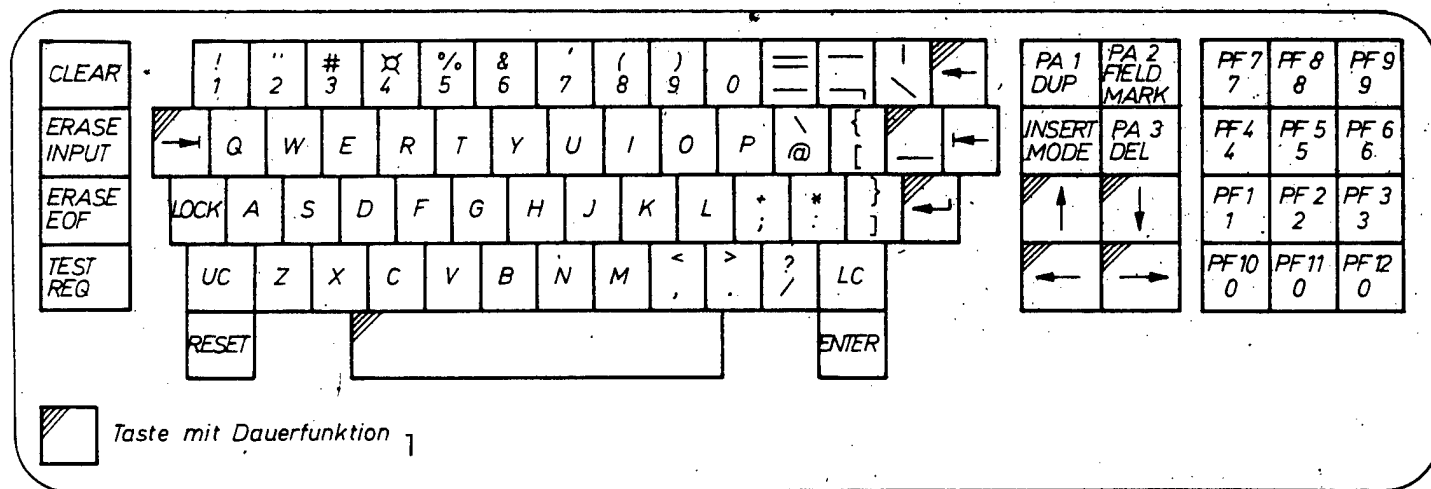
Figure 2. Latin keyboard EC 0101-1.04

1   key with continuous function

The activation of the program access keys PA1 through PA3 now causes transmission of the respective AID to the EDP system. The use of these keys makes it possible for the operator, for example, to begin conversational mode operation, to guide this in a particular direction, or to interrupt it, without additional information needing to be inputted to the keyboard.

The key "test request" (TEST REQ) initiates transmission of a test request message to the EDP system.

The key "total erase" (CLEAR) causes erasure of the entire buffer content.

Erase Keys

Besides the above-mentioned "total erase" key, there are three other erase keys that are adapted to the field concent. These erase keys make it much easier for the operator to input data and altogether to work in the conversational mode. The key "erase input area" (ERASE INPUT) causes erasure of the character positions of all the input fields including the MBT bit. The use of this key is particularly effective when working with tabular input prescriptions. In this case, the inputted data, which have already been transmitted to the EDP system, are erased, and the cursor is positioned at the first input position, to prepare a new input.

The key "erase to the end of the field" (ERASE EOF) is used to erase all characters in an unprotected field beginning with the cursor position up to the next attribute symbol. The parts of individual input fields can thus be erased.

When the "erase" (DEL) key is activated, the character at the cursor position in an unprotected field will be erased. A left shift by one position of the character to the right of the cursor is associated with this. By means of this key, corrections necessitated by a wrong input can be performed without any problem.

Further Function Keys

The key "insert mode" (INSERT MODE) permits the subsequent insertion of characters into an already inputted text. Beginning at the insert point, all characters are right shifted by one position.

The key "duplicate" (DUP) causes input of the symbol DUP and motion of the cursor to the first character position of the next unprotected character field. This key is used, for example, in connection with tabular input prescriptions. If there are successive inputs, and if the values in certain input fields do not change, the operator need not input these values several times, but he merely activates the "duplicate" key, and the problem program inserts the previously received value into this field.

By activating the key "field mark" (FIELD MARK), the symbol FM is inputted into an unprotected field. An application example for this key is the separation of several data blocks of variable length within one input field. The key "reset" (RESET) is used to establish a defined basic state. The keys "upper case" (UC), "lock upper case" (LOCK) and "lower case" (LC) are provided for changing over the corresponding keyboard position.

Cursor Control Keys

The cursor control keys ("to the right" (→), "to the left" (←), "backspace" (←),
"upwards" (↑), and "downwards" (↓)) are used to move the cursor in the direction
shown on the key. The key "tabulation" (→|) is mainly used after a successful
input, to r-ach the first position of the next input field.

The key "new line" (←|) moves the cursor to the beginning of the next line.

The key "back tabulation" (|←) causes the cursor to move to the first character
position of the preceding unprotected field. If, before this key is activated,
the cursor is in an unprotected field other than in the first character position,
the cursor is moved to the first position of the same unprotected field. These keys
offer significant aids to the operator in connection with using the field concept.
Advantages, in particular with respect to input reliability, arise through the
highly specific guidance of the operator during data input.

1.2.4 Switches and Controls

Besides the power switch, the brightness control, and the contrast control, the
display screen unit EC 7927.01 has available an operating lock (key switch). In the
OFF position, no further data is stored in the buffer of the display screen unit
indicated, except for the cursor whose display has already been switched on by the
power switch. Data input is blocked, and the display screen unit is unavailable.
This prevents unauthorized persons from having access to the display screen system
and thus to the programs and files of the EDP system.

The display screen unit becomes available only when the power switch and the
operating lock are both switched on.

1.2.5 Numerical Keyboard Lock

To increase safety, e.g. in the acquisition of numerical data, one uses the numeri-
cal keyboard lock in combination with the field concept. This device guarantees
that no alphanumeric characters, other than digits, commas, periods, minus, and DUP
can be keyed into an input field that has been designated as numeric. If there is
an attempt to input characters other than those mentioned above, the keyboard is
locked. The numerical keyboard lock can be switched off by means of the change-over
keys UC and LC.

1.2.6 Selection Pencil

Use of the selection pencil leads to great facilitation for the operator, especially
with the rapid input of alternative data that are prescribed by the problem program.
The selection pencil input, however, presupposes the use of the field concept.

A field that can be selected with the selection pencil is defined by an appropriately
coded attribute symbol, which must be followed by an identifier (?,>, space, or NUL)
and than at least one alphanumeric character. In the three last character positions
of a selectable field, there must be stored a space or NUL character.

By touching with the switched-on selection pencil, the operator can specify one or more selectable fields for input to the EDP system.

Depending on the identifier of the selectable field, touching with the selection pencil causes the following operations:

If the identifier was a space or NUL character, an I/O message is generated immediately, and the input equipment is locked.

If the identifier was a "?", a ">" is displayed as the new identifier. The field is then indeed selected for transmission to the EDP system, but there is no I/O message.

If the identifier was a ">", a "?" is displayed as the new identifier. Erasure of the MBT bit is associated with this.

The change of identifiers in a display serves the operator as an optical check of his successful selection.

If the input was faulty, the operator can reverse the accomplished selection by renewed touching with the selection pencil.

With all other identifiers, the selection pencil has no effect.

For all the fields that have been selected with the selection pencil, only the addresses and not the contents of the fields are transmitted to the EDP system. This means that the problem program must know the content of the selectable fields, so that the addresses can be linked with the corresponding text. However, it is also possible to have a combined input for the selection pencil and the keyboard. In this, the I/O message must be initiated with the key "input" or with one of the program function keys.

1.2.7 Acoustic Signalling Equipment

The acoustic signalling equipment generates a brief tone when the operator inputs a character into the next to last display position of the display screen or if the problem program arranges this, for example to inform the operator concerning the progress of the conversational mode operation.

1.3 Printer EC 7934.01M

The printers of the display screen system EC 7920M are used to print documents either as a copy of the data shown on the display screen or in correspondence with the printed output indicated by the problem program.

The character inventory of the printer EC 7934.01M comprises 96 characters (Latin and Cyrillic capitals, digits, and special characters). The printing speed is max 50 characters per second. The printer has a buffer memory with a capacity of 1920 characters.

Printing begins after data transmission to the printer and after the instruction for the start of printing from the device control unit.

The advantages of the field concept also apply to the printing operation. For this reason, before printing a check is made whether the line being printed contains attribute symbols, NUL- and DEL-characters, or characters of non-printable fields. These characters are then treated as the "space" character (SP).

The print format is communicated to the printer through the write control symbol WCC or through the copy control symbol CCC. Accordingly, the WCC or the CCC specifies the printable line length either at 40, 64 or 80 characters per line (fixed line length) or the print orders "new line" (NL) and "end of message" (EM) control the line print (variable line length). The print order NL causes line advance, and the print order EM terminates the print operation.

Another print order is the "form forward" (FF). This initiates a form advance to the next STOP for vertical tabulation.

1.4 Display Screen Station EC 7925.01M

The display screen station EC 7925.01M can be connected through modems to the multiplex control unit EC 8404. Multipoint or point-to-point connections are used for communication between the display screen station and the EDP system.

The display screen station consists of a display screen unit comparable to the EC 7927.01, including a numerical keyboard lock and acoustical signalling equipment as well as a mobile connectible keyboard.

Three keyboard variants are available, the Latin, the Cyrillic-Latin, and the Cyrillic keyboard, which have a more advantageous arrangement of some function keys as compared to the keyboard variants of the EC 7927.01. Connection of the series printer SD 1152, as a desk top unit, is possible as an option. The length of the printed line is 80 characters, corresponding to the length of the lines on the display screen. The print copy of the display screen contents can be started by the operator through the keyboard.

Compared to the EC 7927.01, the EC 7925.01M offers the following improvements in application:

The additional orders "roll up" (RU), and "roll down" (RD), and "new writing line" (NWL) facilitate programming with the advantage of saving transmission time.

The possibility of inputting orders, addresses, and attribute symbols through the keyboard permits the definition of fields and formats, by means of the display screen unit.

Additional function keys, such as "insert a line" (INS LINE), "delete a line" (DEL LINE), and "change over the key function" (CTRL) as well as "start printed copy" (REC) increase the functional scope.

1.5 Device Control Units

1.5.1 Device Control Unit for Local Connection EC 7922.01M

The device control unit, in its basic design, has available connections for four display screen units EC 7927.01 and/or printers EC 7934.01M. Through a maximum of seven terminal adapters, each with four terminals, a total of 32 display screen units and/or printers can be connected.

The device control unit controls the execution of commands received from the channel of the EDP system. If no command operation takes place, all the devices are interrogated by the device control unit to determine the current device status. Detection of an I/O message leads to a report to the EDP system.

If a device is addressed by the EDP system, the device control unit stops its cycling device interrogation and provides information concerning the current status of the addressed devices. If the device status permits, the device control unit performs the indicated command operation with this device.

When a write or read command first begins to be executed, the entire buffer content is transmitted from the addressed device to the device control unit. When a read command is executed, the device control unit transmits the data read by the device to the EDP system.

When a write command is executed, the data in the device control unit are modified corresponding to the command and are subsequently transmitted to the device.

1.5.2 Device Control Unit for Connection of the EC 7921.01M

The explanations in Section 1.5.1 apply to the connection possibilities for the units EC 7927.01 and EC 7934.01M, the command operations and the cyclic device interrogation.

On the basis of algorithms of remote data transmission, the device control unit is addressed by special data sequences, is interrogated, and is controlled with commands. In contrast to the EC 7922.01M, an I/O message which comes from a connected unit and which has been detected in the device control unit can be transmitted to the EDP system only after a general interrogation of the device control unit, instigated by the problem program, after a special interrogation of the device, or by a read command. For data transmission between the device control unit 7921.01M and the multiplex control unit (EC 8404) connected to the channel, appropriate modems must be connected as the transmission rate indicates.

2   Organization of the Data Exchange Between an EDP System of RYAD and the Display Screen System EC 7920M

2.1 Commands

2.1.1 Write Commands

The commands "write" and "erase/write" are used to load, format, and selectively erase the device buffer data.
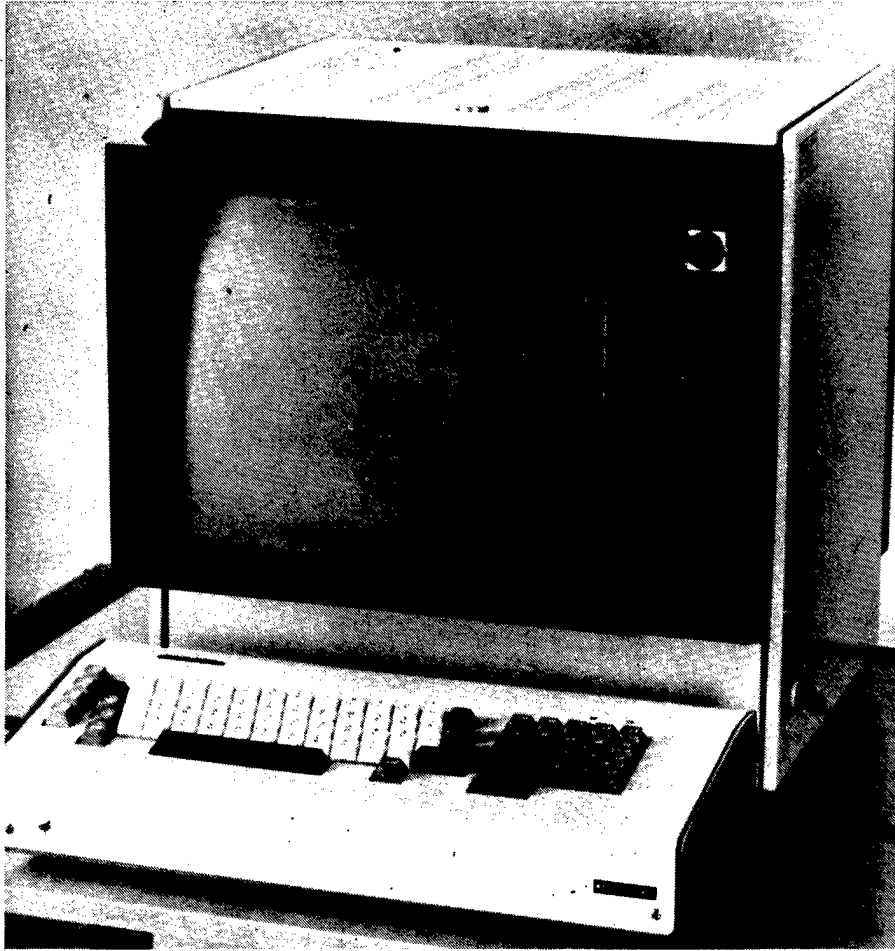
Display screen EC 7927.01

The command "erase/write" first causes the complete erasure of the device buffer and subsequently the writing of alphanumeric characters in dependence on the con-commitantly transmitted orders. This command is used to establish a defined basic state on the display screen. Examples for this are the beginning of conversational mode or if a complete overwriting of the previously displayed information is not possible by a new display.

In contrast to this, the use purpose for the "write" command is a partial modifi-cation of the display screen display, especially when working with tabular input prescriptions.
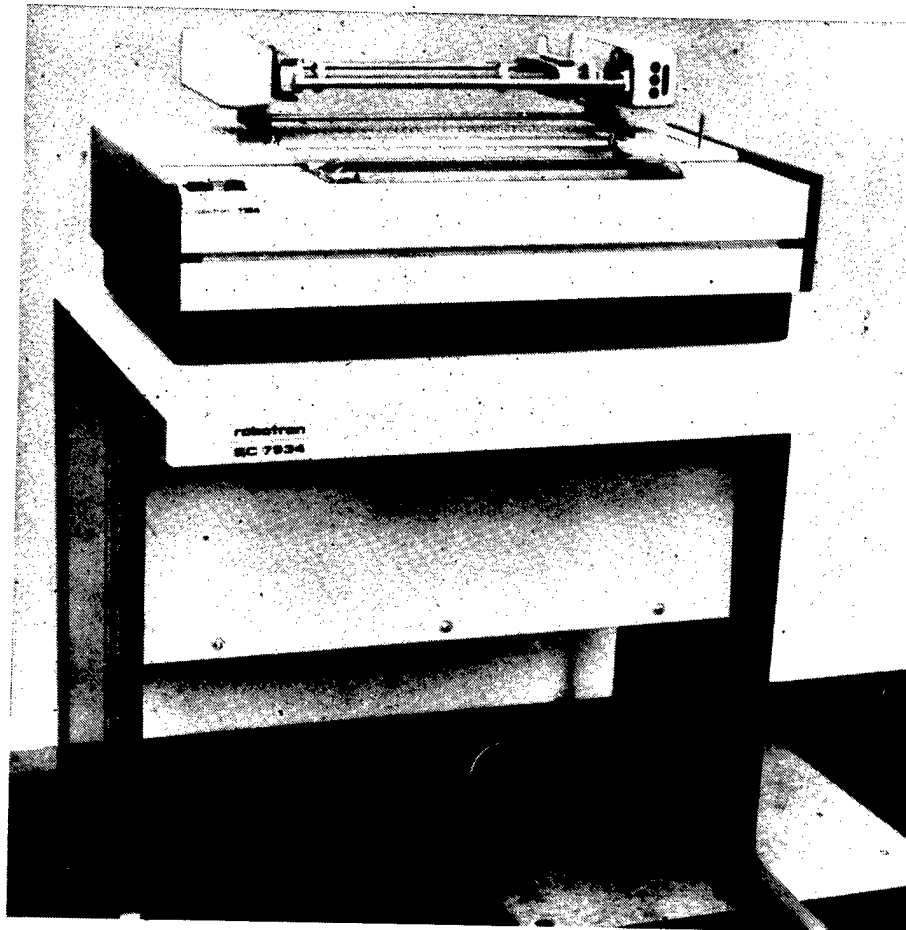
Printer EC 7934.01M

2.1.2 Read Commands

The read commands "read buffer" and "read modified" are used to transmit to the EDP
system the information displayed on the display screen.

The command "read buffer" causes transmission of all data of the device buffer including NUL characters and orders. It is predominantly used for diagnostic purposes.

The read command that is mainly used is "read modified". The read operation being executed refers only to such data fields as were modified by the operator of the display screen unit by means of the keyboard or the selection pencil, that is those fields in which the attribute symbol has the MBT bit set. This results in high efficiency for data exchange when using the command "read modified", since

only alphanumeric characters of the fields which the operator has modified through the keyboard can be transmitted (the data are always identified through the concomittantly transmitted address of the first alphanumeric character),

all blanks are suppressed in the transmission,

only the addresses of the modified fields (no alphanumeric data) are transmitted if the input has been effected with the selection pencil (the alternate responses are already known to the program),

no addresses and alphanumeric data are transmitted to the EDP system if the input has been initiated by one of the three PA keys or through the key "total erase" (the message is identified through the AID symbol).

2.1.3 Control Commands

Besides the commands "control without effect", "sense" and "test I/O", whose function are already known and which are executed only by EC 7922.01M, the user of the display screen system also has available the following control commands:

The command "copy" is executed only by the EC 7921.01M. It can be used to transmit data between two devices connected to the same EC 7921.01M. Here, the selected device is the device to which the data are to be transmitted. The address of the source device is a component of a so-called copy data sequence. The advantage of this command, in terms of the application, consists of the fact that the content of the display screen can also be displayed on other display screen units and/or can be copied on printers without the functions of the EDP system being required for data transmission. This simultaneously implies a decisive reduction of load on the transmission networks and a reduction of transmission time.

The command "select" is executed only by the EC 7922.01M. It causes solely the transmission of the buffer content from the selected device to the device control unit. In this way, the execution time of the commands "write", "read modified", and "read buffer" is shortened and altogether a time unburdening of the channel of the EDP system is achieved.

The command "erase all unprotected fields" is executed by both device control unit types. This command requires the use of the field concept and is used to prepare a new input in input prescriptions. This results in significant facilitation for the operator and in an improvement of input reliability through the implementation of the following functions:

Erasure of all alphanumeric characters in all unprotected fields by entering NUL characters

Resetting the MBT bit of all unprotected fields

Release of the keyboard

Resetting the I/O message in the display screen unit

Positioning the cursor to the first character position of the first unprotected field.

After these operations have been automatically executed, a new input process can begin.

2.2 Orders

In addition to the above-mentioned print orders NL, EM, and FF, there are also orders in the display screen system EC 7920M, which are absolutely necessary for application of the field concept. These are control characters and control character sequences, which are transmitted in between alphanumeric data in write and read data sequences. These orders are used to define fields, to position and erase data, and to control the cursor.

The order "start field" (SF) announces, in a data sequence, an attribute symbol as the next character.

The order "set buffer address" (SBA) sets up a new buffer address that can be selected by the user, beginning at which a write operation is to be started or continued or beginning at which other orders are to be executed. In a read data sequence, this order advances the first alphanumeric character of a modified field in connection with the command "read modified".

The order "set cursor" (IC) causes the setting of the cursor at the location at which the next alphanumeric character is to be written into the buffer. This order represents a significant input aid, since the cursor can be positioned by the problem program at the first character position of the first input field.

The order "programmed tabulation" (PT) sets the current buffer address to the position of the first alphanumeric character of the next unprotected field. Furthermore, in the normal case, this order erases all positions, beginning at the current buffer address and up to the end of the field.

The order "character repetition up to address" (RA) contains a character which is written in repeatedly, beginning with the current buffer address until the address specified in the order sequence has been reached (exclusively). This is particularly useful when transmitting a large number of similar alphanumeric characters, e.g. special characters for the visual organization of tables.

The order "erase unprotected field up to address" (EUA) writes NUL characters into all unprotected positions, beginning at the current buffer address up to the address specified in the order sequence. However, the order does not change the attribute symbols of the respective unprotected field.

2.3 Control of the Local Display Screen System EC 7920.01M through the RYAD Channel

Communication betweeen the channel and the device control unit EC 7922.01M takes place on the basis of the operational principles of RYAD.

Initiated through an instruction START I/O, the channel in accord with the channel program being executed, controls the operations in the device control unit through information that is being transmitted through the RYAD standard interface. The device control unit informs the channel of the central unit through the status byte concerning the statuses existing in the selected device, in various phases of command operations or even when no command operations are being executed.

2.4 Control of the Display Screen System EC 7920.11M

The remotely connected display screen system EC 7920.11M communicates with the problem program through modems, transmission lines and a multiplex control unit (EC 8404).

A synchronous data transmission system (BSC) is utilized. Transmission takes place in two-sided semi-duplex operation through a four-wire dedicated line. The control algorithm utilized corresponds to the operating mode for multipoint connections.

At the beginning of an operation with the display screen system an instruction START I/O addresses the multiplex control unit in a transmission line, but, because of the operating mode of the multipoint connection, not the device control EC 7921.01M. The channel commands are executed in the multiplex control unit. These are not commands for the display screen system EC 7920.11M.

The device selection and the command operations with the devices of the display screen system EC 7920.11M are implemented with the following transmission procedures.

With interrogation addressing, three different addressing sequences must be distinquished:

The special interrogation addresses one EC 7921.01M and a connected device or an EC 7925.01M. If data are ready for transmission to the EDP system, a read operation is executed as with the command "read modified".

The general interrogation addresses only one EC 7921.01M for the step-by-step testing of every connected device. Data which are ready are transmitted to the EDP system in the sequence of interrogation. For this purpose, only one read operation always takes place as with the command "read modified".

Diagnostic interrogation is used for checking whether the connection with the EC 7921.01M or the EC 7925.01M has been established.

The selection addressing selects a device or an EC 7925.01M which is connected to the EC 7921.01M, for subsequent execution of a command. After the selection addressing has been performed, a command sequence can be emitted by the EDP system.

3. Program Support

The program support of the display screen system EC 7920M is secured by the components BTAM, TCAM, the message scheduler, and the CRJE in the operating system OS/ES, Edition 6.1. Support through the access method BCAM in the operating system DOS/ES is provided in Version 1.74. Furthermore, the user must do some programming work, however, whose scope depends on the particular problem. This programming work begins with the specification of information which is to be exchanged between the problem program and the operator of the display screen unit. This information is to be arranged according to the rules of the field concept in the form of pictures. It here proves suitable to enter this information, including the attribute symbols, on form sheets (24 lines with eight columns each) corresponding to the desired display-screen display.

A row/column code can now be entered into another form sheet for every attribute symbol and for every order. The subsequently transmitted buffer address of a display-screen unit or of the printer will be determined from this.

Finally, a program is coded which causes display of the information on the display screen and which processes the operator inputs. This program consists of a few assembler statements and represents a connecting element between the problem program and the access method. The assembler statements comprise hexadecimal codes for all orders and attribute symbols, the associated buffer addresses, as well as the text being transmitted.

4. Advantages in Using the Display-Screen System EC 7920M

Compared to the display-screen technology previously used in RYAD, the display screen system EC 7920 offers the user a large number of advantages.

It facilitates operation and increases reliability during data input. These advantages are guaranteed by the following functions:

Due to a purposeful arrangement of fields on the display screen, the field concept makes possible data input by way of tabular input prescriptions.

Through the programmable display brightness, priorities can be created for treating the displayed information.

Alternative information prescribed by the problem program can be selected for transmission to the EDP system by means of the selection pencil (no keyboard operation required).

Because the keyboard functions are optimally adapted to the field concept (e.g. tabulation, erasure, insertion), only a few operating steps are required.

The programmable setting of the cursor makes it possible to guide the operator during data input.

The numerical keyboard lock prevents input of non-numerical data in certain fields.

An acoustic signal calls the operator's attention to certain conditions, on which further operator actions depend.

An operations lock prevents unauthorized persons from having access to the display screen units and thus the programs and files in the EDP system.

The application possibilities are expanded by the following features:

a larger display capacity (1920 characters)

several keyboard variants adapted to the problem

display-screen units and printers within one configuration, which can be set up locally and remote

the possibility of expanding a local or remote device control unit from four to 32 connections

association of one or more printers with one or more display-screen units

data transport from one display-screen unit to another one or to a printer, initiated by the operator or by the problem program.

The following features increase the efficiency of data exchange:

suppression of irrelevant characters (e.g. erased locations or successive similar characters) during data transmission,

addressing of individual buffer positions and thus the possibility of writing and reading data selectively,

reading information exclusively from fields which were modified by the operator during input,

program-controlled erasure of all data in input fields through the transmission of individual command codes and orders,

programmable tabulation after data output with the erase function up to the end of the field.

1979 Performance Specifications for the EC 7920(M)

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German
Vol 16 No 11, Nov 79 back cover

[Back cover series on "EDP-Equipment", signed "He.": "EC 7920(M) Display System"]

[Text] Technical Data: Device control unit EC 7921.01 (M) and EC 7922.01 (M)

Connection to the central unit

	EC 7921.01	EC 7922.01
Connection picture	I 2 (CCITT V 24) with modem and MPD	SIF RYAD
Code	KOI-7	DKO1
Data transmission rate	9600 bit/s	maximal 380 kbyte/s
Connection distance	according to postal lines	maximal 60 m

Connection from the EC 7927.01 and EC 7934 (M)

Device interface	KIF EC 7920
Number of device connections	maximally 32, in steps of four similar connections
Code	14 bit code (system internal)
Data transmission rate	864 k bit/s
Maximum connection distance	1200 m
Connection to the line	220 V + 10 percent/- 15 percent
Line frequency	50 Hz + 1 Hz
Power consumption	about 300 W
Dimensions	750 x 1200 x 400 mm

Display screen unit EC 7927.01

Device interface	KIF EC 7920
Display screen capacity	1920 characters
Character inventory	128 characters
Keyboards	possibility of four keyboard types
Dimensions	460 x 468 x 600 mm desk-top unit
Weight	about 56 kg
Power consumption	about 165 W

Printer EC 7934.01 (M)

Device interface	KIF EC 7920
Character inventory	displays 84 characters
Printing output continuous	45 characters/s
Printing output start-stop	25 characters/s
Line width	132 characters
Paper equipment	continuous fan-fold equipment

This system makes available universally useable communications stations. Their application for directed acquisition and conversational mode operation is possible in nearly all areas of the national economy in combination with the data processing systems of the RYAD.

The system consists of the device control units for remote and local connections, of the display screen units, and of autonomous printers, which are connected to the device control unit.

Device control unit for remote connection EC 79.21.01 (M)

The device control unit controls data exchange between an EDP system of the RYAD and the decentrally disposed display screen units and printers. On the computer side, the connection takes place through modem - multidata transmission lines - modem - multiplexer with synchronous connection control - EDP system of the RYAD; on the device side, the connection is made through the small interface (KIF) EC 7920 to the display screen units and the printers.

Thirty-two terminal devices (display screen units or printers) can be connected; however, at least one display screen unit must be included. For expanding the connection, supplementary equipment is available for four connections. Since the device control unit can be expanded with a maximum of seven supplementary devices, the connnection of maximally 32 terminal devices is possible.

Main functions:

Detecting and responding to received addressing sequences from the computer

Controlling operations which are necessary to execute commands transmitted from the computer to the device control unit

Verifying the current status of the terminal devices, such as readiness, completion of the command operation, I/O message or errors in the device - when all the command operations have been executed.

Device control unit for local connection EC 7922.01 (M)

The device control unit controls data exchange between an EDP system of the RYAD and locally disposed display screen units and printers. On the computer side, the connection is made through SIF RYAD to a selector-, multiplex-, or block multiplex-channel (RYAD II) and, on the device side, through the IF EC 7902 to the display scrren units and printers. On the device side, 32 terminal units can also be connected to this device control unit, where the same considerations hold as were noted for the device control unit EC 7921.01 (M).

Main functions:

Controlling and monitoring the interface channels

Controlling the operations which are necessary to execute commands transmitted by the computer to the device control unit

Verifying the current status of the terminal units after completion of the command operations.
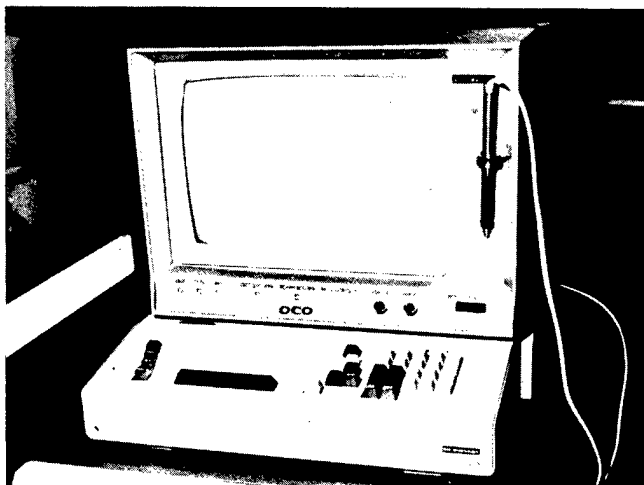
Photo of the EC 7927.01 (M)

Display Screen Unit EC 7927.01 (M)

The display-screen unit (photograph) is used to input and output information in conversational mode with an EDP system of the RYAD through device control units for remote and local connections.

The display-screen unit is designed as a desk-top unit. Its basic variant is composed of the alphanumeric display screen and the keyboard.

An operations lock, an acoustic signalling device, and a numerical keyboard lock are contained in the basic equipment. As supplementary equipment one can connect a selection pencil.

The display-screen unit has a buffer memory of 1920 characters and can reproduce 24 lines with 80 characters each.

Printer EC 7934 (M)

The printer, as an autonomous desk-top unit, can be coupled with device control units for local and remote connections.

The printer is used for making copies of display screen data (printable data of the buffer) and for the print output of data which are transmitted by the EDP system through write commands connected with a write control character (or copy control character in the case of a remote set-up).

8348
CSO: 2302/4

EC 7902M HARDWARE STATION FOR EC 1055M COMPUTER DESCRIBED

Performance Specifications

East Berlin RECHENTECHNIK–DATENVERARBEITUNG in German
Vol 18 No 5, May 81 back cover

[Back cover series on "EDP Equipment", signed "Roe": "EC 7902M hardware station"]

[Text] Technical data:

Power consumption: 1.3 kW
Weight: 260 kg
Paper tape unit 1:
information input rate: 300 characters per second
information output rate: 50 characters per second
data medium: paper tape, five or eight track
Paper tape unit 2:
information input rate: 1000/500 characters per second, convertible
information output rate: 50 characters per second
data medium: five track or eight track paper tape
Cassette unit:
tape speed: V_1 = 19 cm/s V_2 = 38 cm/s
transmission rate: 0.75 k bytes/s or 1.50 k bytes/s
tape transport function: forward/backwards; fast tape transport forwards and
 backwards with v ≃ 1.5 m/s; rewind with v ≃ 1.5 m/s
number of tracks per cassette: 2
testing possibilities for the information: read-after-write
data medium: digital cassette after ISO 3407

The equipment station EC 7902M is an I/O unit with a standard connection picture
SIF ESER (RYAD) for paper tape and magnetic tape cassettes as data media. This
unit replaces the paper tape station EC 7902. The expansion concerns the input
and output possibilities through a cassette. There are two equipment variants:

EC 7902M1 - paper tape technology and cassette technology

EC 7902M2 - paper tape technology

The variant EC 7902M1 will be made available at a later stage.

Equipment station EC 7902M

The equipment station is built in standardized rack technology. The inserts or racks, from top to bottom, comprise the following:

the operating panel with the device control unit and the power supply
the first paper tape unit
the second paper tape unit
a pull-out storage compartment
the cassette unit
the maintenance panel with the power and channel connection.

The paper tape units with various device power each comprise a paper tape reader and puncher with control electronics and with the power supply necessary for this. The cassette unit consists of two drives and the power supply. With the equipment variant EC 7902M2, this module is omitted.

The device control unit guarantees the channel connection and the connection control of the three device insert modules. It is microprocessor-controlled and works with microprograms for the individual function complexes. After switch-on, an internal microtest automatically tests all the essential functions of the device control unit.

Each device of the equipment station has its own device address. It is possible that all six devices work quasi-simultaneously with the channel in multiplex operation. Duplicating and comparison of paper tapes is possible in off-line operation.

The technical program support of the equipment station is furnished within the framework of an expansion of Edition 6.1 of the OS/ES.
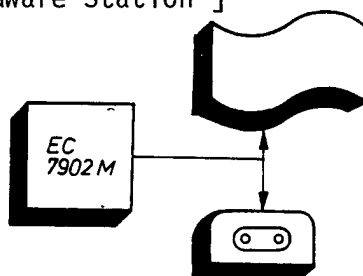
Besides new functional capabilities, the following features increase the utility for the user as compared to the previous paper tape station EC 7902:

higher reliability by using the most modern components
lesser space area for the equipment (reduced from about 1.5 m^2 to about 0.5 m^2)
lower weight (about 268 kg in place of 325 kg)
a smaller volume (reduced from 1.45 m^3 to about 0.8 m^3).

Description of EC 7902M Equipment

[Article by Manfred Roeger, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 7902M Hardware Station"]

[Text] The equipment station EC 7902M is an I/O unit with the standard connection picture SIF RYAD for paper tape and magnetic tape cassettes as data media. This unit replaces the paper tape station EC 7902. The expansion concerns input and output capabilities to the cassette. There are two device variants:

EC 7902M1 - paper tape technology and magnetic tape technology

EC 7902M2 - paper tape technology.

The variant EC 7902M1 will be furnished at a later stage.

Besides the new functional capabilities, the following features increase utility for the user as compared to the previous paper tape station EC 7902:

Higher reliability by using the most modern elements
A smaller base area for the equipment (reduced from about 1.5 m^2 to about 0.6 m^2)
A smaller weight (about 260 kg in place of 325 kg)
A smaller volume (reduced from 1.45 m^3 to 0.8 m^3)

1. Structure of the Equipment Station

The equipment station (Figures 1 and 2) is built in standardized rack technology. The inserts or racks, from top to bottom, comprise the following:

the operating panel with the device control unit and the power supply
the first paper tape unit
the second paper tape unit
a pull-out storage unit
the cassette unit
the maintenance panel with the power and cable connections

The paper tape units with various device power each comprise a paper tape reader and puncher with control electronics and with the necessary power supply. The cassette unit consists of two drives and the power supply. With the device variant EC 7902M2 the latter module is omitted.

The device control unit guarantees the channel connection and the connection control of the three device modules. It is microprocessor controlled and works with micro-programs for the individual function complexes. After switch-on, an internal micro-test automatically tests all the essential functions of the device control unit. Each device of the device station has its own device address. It is possible that all six devices operate quasi-simultaneously with the channel in multiplex operation. Duplicating and comparing the paper tapes is possible in off-line operation.

The technical program support for the device station will be furnished within the framework of an expansion of Edition 6.1 of the OS/ES.

2. Paper Tape Units

2.1 Paper Tape Unit 1

The paper tape unit is built as an insert module according to the modular principle. The full interchangeability of the individual modules is guaranteed by adhering to the prescribed tolerances. The paper tape unit uses five track or eight track standard paper tapes.

The speed of the paper tape reader in run-through operation is 300 characters per second and in start-stop operation maximally 100 characters per second. The trans-port track and information tracks are scanned photoelectrically in the see-through method.

The output rate of the puncher is about 50 characters per second. The paper tape is punched mechanically. An electric checking device is present for detecting punching errors. The module must be pulled out of the cabinet for inserting a new roll of paper tape into the punch.

2.2 Paper Tape Unit 2

This paper tape unit belongs amongs the _fast_ paper tape units. It makes possible a reading speed of 1000/500 characters per second and a punching speed of 50

characters per second. The paper tape reader can be switched over from one speed to the other. Start-stop operation is possible. The paper tape unit uses five track or eight track paper tape. The module must be taken out of the cabinet to insert a new roll of paper tape into the punch. The paper tape reader likewise works after the photoelectric principle in the see-through method.

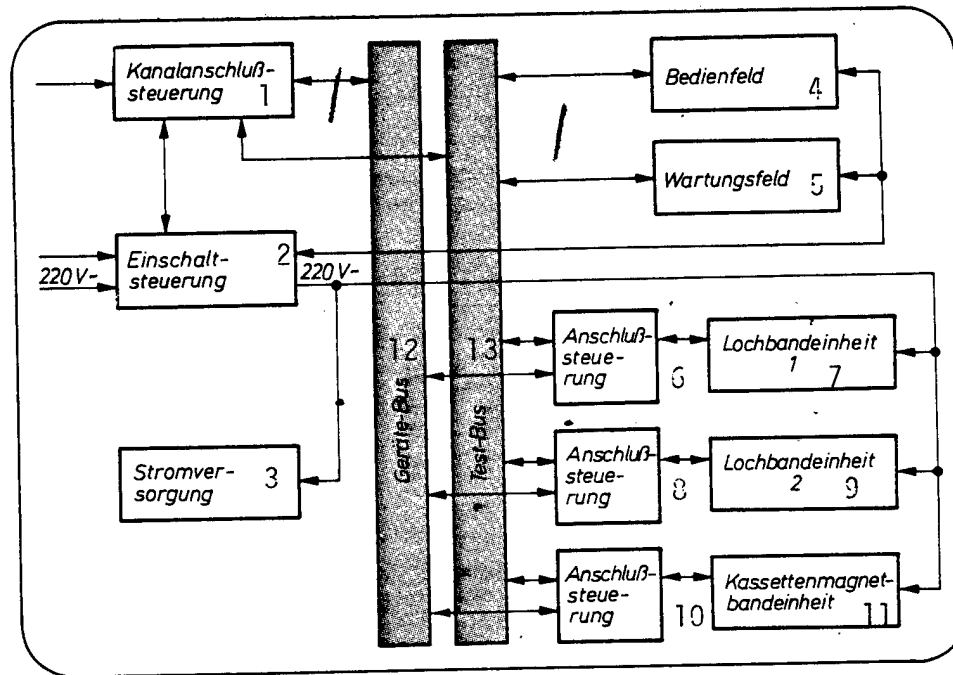Figure 1. Block circuit diagram of the device station EC 7902M1

1   channel connection control
2   switch-on control
3   power supply
4   operating panel
5   maintenance panel
6   connection control
7   paper tape unit 1
8   connection control
9   paper tape unit 2
10 connection control
11 cassette unit
12 device bus
13 test bus

3. Cassette Unit

The cassette unit consists of two cassette devices in one module. The cassette unit contains a three-motor drive with control electronics. It can be used in a combined recording-playback unit. The tape speed is 19 and 38 cm/s forwards and backwards. With fast tape transport, the tape speed is 1.5 m/s forwards and backwards for an evaluatable analog signal. The digital cassette after ISO 3407 (tape width 1/8 inch) is used as the data medium. The device works with phase-encoded recording with a bit density of 32 bits/mm.

4. Operating and Indicator Elements

The operating panel on the front plate of the uppermost insert module of the equipment statement can be subdivided into three function complexes:

Basic status indicator/operation
Device selection and assignment
Uniform operating panel corresponding to the assignment

The first complex contains on/off keys and the technical error indicator. By means of the second complex (device selection key with indicator, intervention necessary indicator), the corresponding operating elements of the uniform operating panel are assigned to a particular device. By means of the keys, indicators, and rotary switches of the uniform operating panel, all the remaining necessary indicator and operator functions can be implemented.

Besides the operating panel of the equipment station, each device insert module also contains specific operating and indicator elements.

5. Maintenance Panel

The maintenance panel, which can be   tilted out and which is housed in the lower-most insert module, guarantees the handling of maintenace tasks and of trouble-shooting with high efficiency. Among other things, it comprises a main switch, a switch for the power supply control, keys for selecting the micro-test runs, indicators for selected registers, temperature monitoring indicators and damage indicators.

Figure 2. Technical parameters of the equipment station

Power consumption	1.3 kW
Weight	260 kg
Paper tape unit 1:	
information input rate:	300 characters/s
information output rate:	50 characters/s
data medium:	paper tape five or eight tracks
Paper tape unit 2:	
information input rate:	1000/500 characters/s, convertible
information output rate:	50 characters/s
data medium:	paper tape, five or eight tracks

Cassette unit:

tape speed:	V_1 = 19 cm/s; V_2 = 38 cm/s
transmission rate:	0.75 k byte/s or 1.50 k byte/s
tape transport functions:	forwards/backwards; fast tape transport forwards and backwards with $v \simeq 1.5$ m/s; rewind with $v \simeq 1.5$ m/s
number of tracks per cassette:	2
test possibilities for the information	read-after-write
data medium:	digital cassettes after ISO 3407

8348
CSO: 2302/4

MATRIX MODULE FOR EC 2655, EC 2655M CENTRAL UNITS DESCRIBED

[Article by Roland Geissler, Mathias Riesen, Friedhelm Seifert, VEB Robotron ZFT
(Center for Research and Technology), Dresden; Dr Rolf Gruner and Klaus Wendlik,
VEB Robotron ZFT, Karl-Marx-Stadt: "Matrix Module"]

[Text]
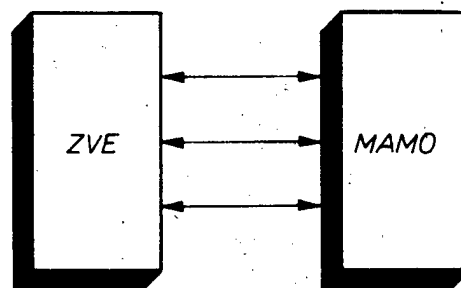
For the central unit (CPU) EC 2655 and EC 2655M there is a special computing unit
(matrix module or MAMO for short) which is offered as supplementary equipment.
The MAMO cannot be connected to other central units of ESER (RYAD).

The selection of the implemented algorithm was made with the objective of making
possible, for the widest possible range of users, a considerable speed up in job
processing.

The important application areas are the following:

seismic data processing
optical calculations
input processing
the energy business
building statics
optimization problems of the electronics industry
research problems
statistics of the national economy
meteorology
eigenvalue problems

The performance capabilities of the MAMO field instructions is greater by a factor of < 70 compared to the corresponding assembler programs on the EC 2655. The high parameter flexibility of the MAMO field instructions permits effective tailoring to numerous user problems. Besides the performance aspects, the great simplification of user programs through the use of MAMO instructions is an important feature for the user. Altogether, 28 MAMO field instructions are made available to the user for solving problems.

1. Connection and Basic Operating Mode of the MAMO

Some special processors, e.g. IBM 2938 and IBM 3838, are operated within the EDP system like an I/O unit over the I/O system.

Studies have shown that the introduction of powerful special functions alone satisfies only a portion of user needs. In practice, special functions are nearly always imbedded in a context of universal processor instructions and/or programs.

Finally, the execution time of the total special problem is of interest to the user and not the execution time of an isolated special function, i.e. to solve a problem with special functions, a device solution must be found which reduces to a minimum the explicitly necessary organizational effort for completing the task (operating system and, in some cases, monitor programs). But associated with this are also those properties which help to simplify the programming work, such as

use of virtual storage,
simple linkage of special functions to the program which are formulated in higher programming languages.

Furthermore, aspects of the effective further development of the device solution must also be considered. These aspects permit reliable utilization of progress in the area of system architecture and computer technology.

For the anticipated functional scope and for the expected application areas, a linkage of special functions as an extension of the instruction spectrum of the universal processor has turned out to be the most effective solution. Figure 1 shows that the MAMO is connected as a computer unit extension through a three-component special interface (1, 2, 3). The MAMO consists physically of a RYAD cabinet including the power supply.

Data exchange from the MAMO data buffer, through the storage adapter, with main storage (MS) takes place through the component interface 1. The data paths have a double-word width. The storage adapter handles either CPU access (CPU = central processing unit) or MAMO access. The particular requests that are handled depend on a MAMO mode trigger. When activity changes, this trigger is switched over by a CPU microprogram. The MS access to the channel complex has basic priority.

The component interface 2 permits direct control data exchange between the computer unit of the CPU and the control complex of the MAMO. The control functions are executed through this interface. These are used to start, to continue interrupted MAMO instructions, and to terminate algorithmic MAMO execution sequences. The access information (addresses, etc.) for MS access of the MAMO are likewise contained therein.
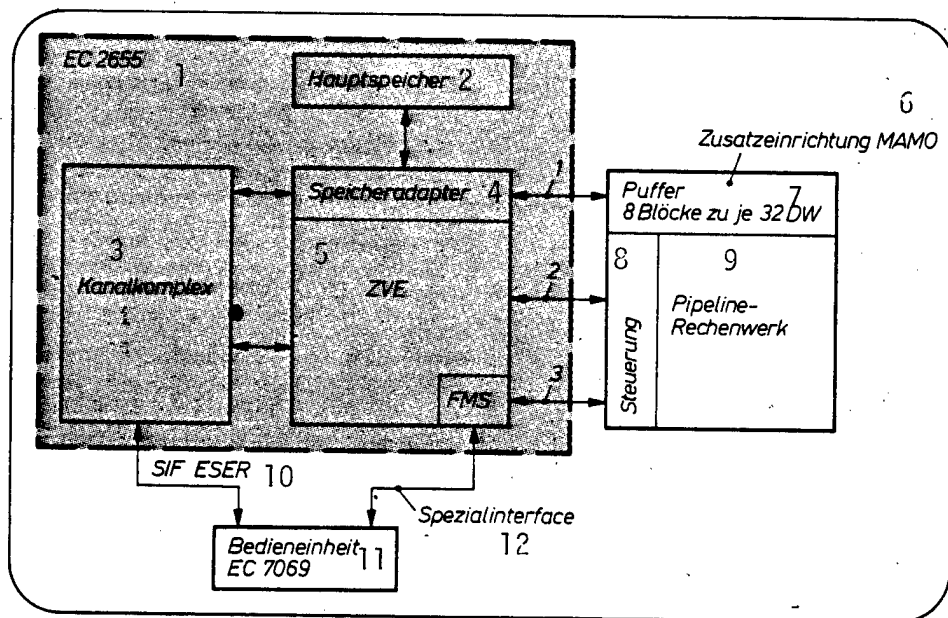
Figure 1. Connection of the matrix module through a three-part special interface

1   EC 2655
2   main storage
3   channel complex
4   storage adapter
5   CPU
6   supplementary device MAMO
7   buffer, eight blocks with 32 DW each
8   control
9   pipeline computer unit
10 SIF RYAD
11 operating unit EC 7069
12 special interface

Component interface 3 is used for diagnostics and for service-operator controls through the operations unit EC 7069 or the operating and service processor (BSP) EC 7069M. All three component interfaces work synchronously with a timing cycle of 380 ns.

The CPU executes several standard functions for the supplementary computing unit MAMO, e.g.:

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Preparation and decoding of instructions
Starting algorithmic execution sequences in the MAMO
All types of MAMO instruction terminations
Machine error evaluation corresponding to the RYAD operation principles
Organization and supervening control of all diagnostic processes in the MAMO by CPU
microprograms
Handling the MAMO-MS accesses
Communication with EC 7069, etc.

Furthermore, all MAMO control instructions are executed by the CPU and all operating
conditions of the MAMO are monitored.

The pipeline computer unit in the MAMO, as a high-performance computer unit, is
capable, with a short format in the processing (short RYAD floating point numbers),
of executing simultaneously 2.5 million additions and 2.5 million multiplications
per second.

2. General MAMO-Specific Basic Ideas

2.1 MAMO Instructions

The MAMO is addressed by machine instructions. These represent an extension of the
instruction spectrum of the EC 2655. MAMO programs consist of a sequence of CPU
and MAMO instructions, all of which run under the control of the same PSW.

All MAMO instructions (Figure 2) have the operation code X'E1'. Through the sub-
code (UC), they are subdivided as follows:

control instructions (UC = ØØ...7F)
field instructions (UC = 8Ø...FF).

The nine control instructions cannot be interrupted. They are partly privileged.
Except for one control instruction, they are implemented in the CPU alone and do
not use the MAMO. The field instructions can be interrupted. They are implemented
jointly by the CPU and the MAMO. The MAMO here essentially takes over the algo-
rithmic part of the instructions. The field instructions generally process large
quantities of data which cannot be described in the instruction itself. Conse-
quently, the address of the second operand (base register B2, shift D2) points to
the parameter block (PAB), which contains all the required specifications concerning
the data being processed and being generated, as well as other parameters for con-
trolling the MAMO-internal execution sequences. The address of the first operand
points to the message block (MIB), in which the MAMO, at the end of an operation,
makes available all the necessary information for the user, e.g. communications
concerning the generated data or, in the case of termination of the algorithmic
task, specifications concerning the cause of the termination.

2.2 Data Kinds and Data Types

In the MAMO field instructions, indices, components, rows, fields, and scalars are
processed.
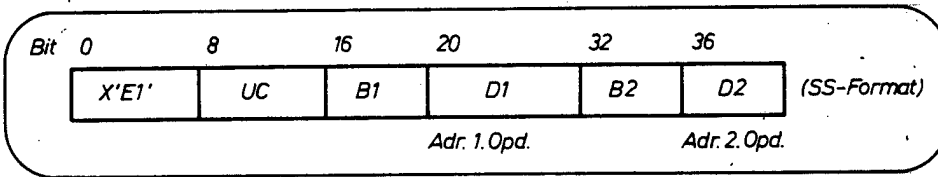
Figure 2. Structure of a MAMO instruction
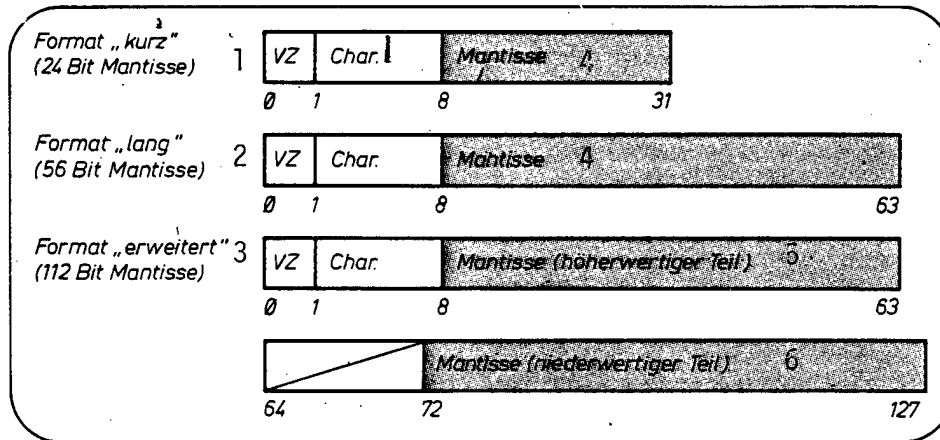
Figure 3. Floating point number with a format corresponding to the RYAD operation principles.

1   format "short"   (24 bit mantissa)
2   format "long"   (56 bit mantissa)
3   format "expanded" (112 bit mantissa)
4   mantissa
5   mantissa (most significant part)
6   mantissa (least significant part)

An index j is an unsigned fixed point number in the range $0 \leq j \leq 2\exp15-1$.

A component A[i,j] or a[j] is a value (Figure 3) to which an index j can be assigned; here, the row number i lies in the range $0 \leq i \leq 2\exp15-1$.

A row a or A[i] is an ordered set of components of the same format (e.g. a vector); the number of components is called the step number S, $0 \leq SA-1 \leq 2\exp15-1$.

A field A is an ordered set of rows of the same step number and with the same format (e.g. a matrix); the number of rows is called the row number R, $0 \leq R-1 \leq 2\exp15-1$.

A scalar d is a value to which an index cannot be assigned.

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The storage of components, rows, and fields can be effected in two different ways:

Non-indexed type of data storage, where only the values are stored

Indexed type of data storage, where the indices associated with all the values of the components are explicitly stored together with said values (in the literature frequently called compact storage).

2.2.1 Non-Indexed Components, Rows and Fields

A non-indexed component A[i,j] consists of a value of the format of the component; the index is not stored; it is implied from the relative address of the storage location of the value, relative to the beginning of the row.

A non-indexed row A[i] consists of non-indexed components A[i,∅], A[i,1], ... A[i,SA-1]; here, the address of the value of the component A[i,∅] is called the address of the row Adr. A[i]. The value addresses of the individual components of the rows are determined as follows:

  Adr. A[i,j] in bytes: = Adr. A[i] + j*WA*F

j= 0,1,..., SA-1
WA: step width, WA = $\pm$ 1, 2, 4, 8
        4 if FA = short
F =   8 if FA = long
       16 if FA = extended

In the case of resultant rows, the step width is always $W_c = \pm 1$, i.e. the non-indexed row c is generated by a gapless storing of the values of the components. A non-indexed field A (Figure 4) consists of non-indexed rows A[∅], A[1],...A[R-1] of the same step width. The address of the row A[∅], here is called the address of the field Adr. A.

The addresses of the rows in the field are determined by:

  Adr. A[i] in bytes: = Adr. A + i*D*F

i = 0,1,..., R-1
D: row distance, ∅ $\leq$ D-1 $\leq$ 2exp15-1.

2.2.2 Indexed Components, Rows, and Fields

An indexed component A[i,j] consists of a value of the format of the component and the explicitly stored index j. Components whose value is a true zero may not be stored. Four components, whose value and index are stored explicitly, are always collected together to a component block (Figure 5).

An indexed row A[i] consists of indexed components through gapless linkage of component blocks. Access to an indexed row takes place through the row head RK (Figure 6).

If a row A[i] does not contain explicitly stored components, i.e. all values of the row are zero, one sets YA[i] = ∅.
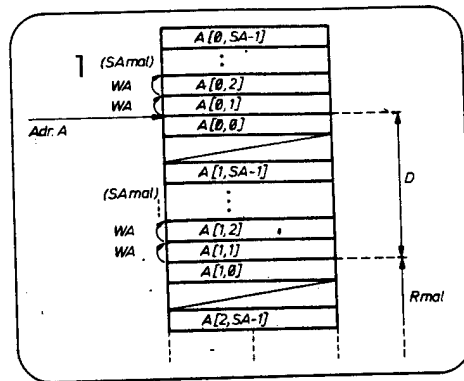
Figure 4. Example of a non-indexed field with WA less than Ø

1   SA times
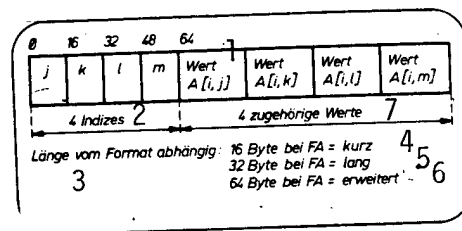
Figure 5. Component block

1   value
2   four indices
3   length of format depends on
4   16 bytes if FA = short
5   32 bytes if FA = long
6   64 bytes if FA = expandèd
7   four associated values
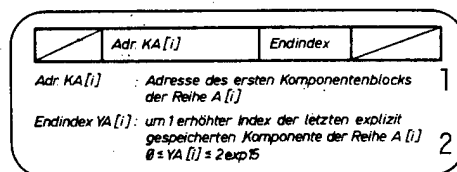
Figure 6. Row head RK

1   address of the first component block of row A[i]
2   final index YA[i]: index incremented by 1, of the last explictly stored compo-
     nent in row A[i], $Ø \leq YA[i] \leq 2exp15$

An indexed field A (Figure 7) is obtained by the linkage of the row heads of the indexed row A[0], A[1],...,A[R-1], where the address of the row A[0], i.e. the first row head, is called the address of the field Adr. A. The addresses of individual rows, i.e. of the row heads, of the field are determined as follows:

Adr. A[i] in bytes: = Adr. A + i*8

i = 0, 1, ..., R-1
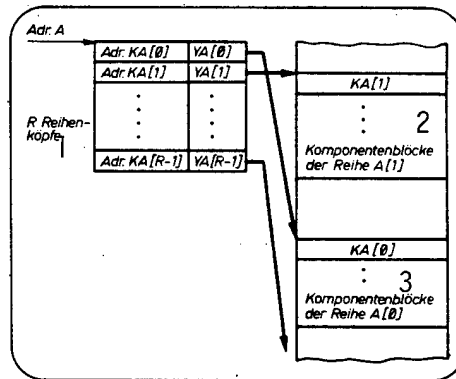
Figure 7. An example of an indexed field

1   R row head
2   component blocks of the row A[1]
3   component blocks of the row A[0]

2.3 Parameter Block PAB

The parameter block PAB comprises the required specifications concerning the data structure as well as the specifications for processing the data in the MAMO (Figure 8).

Depending on the particular field instructions, various double words (DW) are undefined, e.g. for scalar d DW5, for operand b DW4, etc.

Besides the specifications for the data structure, such as the addresses Adr. A, b, c, d, the step numbers SA-1, Sb-1, the row number R-1, the DW2-5 of the PAB also contains the parameters step width WA, Wb, Wc, type TYA, TYb, TYc, as well as the format FA, Fb, Fc, Fd. As another parameter, the sign transformation BZTA, VZTb, VZTc, VZTd can be selected. The sign transformation (Figure 9) offers the possibility of processing the components of a row, of a field, or of a scalar, with a different sign than is given in the MAMO, or to store them with a different sign than the calculated one.

Through the options specified in DW1, the processing of MAMO instructions can be modified and/or can be expanded by additional functions:

	0	8	32	40	48	56	63
DW0	int. Par.	Schutzadr. PA	MASK		FORT		
DW1	Opt.	Adr.e	Index X		Reihenabstand D-1		
DW2	a-Par.	Adr.A	Schritt-zahl SA-1		Reihenzahl R-1		
DW3	c-Par.	Adr.c					
DW4	b-Par.	Adr.b	Schritt-zahl Sb-1				
DW4	d-Par.	Adr.d					
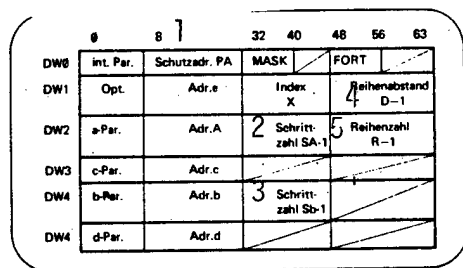
Figure 8. Structure of the parameter block PAB

1 protection address PA
2 step number SA-1
3 step number Sb-1
4 row distance D-1
5 row number R-1

Figure 9. Sign transformation

VZT   Processing or output

00   value
01   - value
10 |value|
11   - |value|

Option 1 - reset the write address
Option 2 - test the resultant component
Option 3 - store explicit zeroes
Option 4 - search a resultant component

Option 1 is effected when one tries to store something at the protection address PA, specified in the DW0, in main storage. This causes the algorithmic exception condition SO. When option 1 is chosen, and if the interrupted field instruction is continued, the double word whose writing into MS was prevented by SO, is written at the original Adr. c or Adr. Kc. The other components of the. resultant row are written in sequence. The user must save the storage region in MS before continuation of the field instruction.

Option 2 makes possible:

substitution according to a barrier,
search for extremal values.

With substitution according to a barrier e (address Adr. e in DW1), the values W of
the resulting components, which fulfill the substitution condition, are replaced
by a true zero of the same format, or the magnitude of the value is replaced by the
magnitude of the barrier (Figure 10).

e < 0		e > 0	
Substitutions- bedingung 1	Substitution 2	Substitutions- bedingung 1	Substitution 2
0	keine	|w| < e	w := 0
w < e	w := e	W < e	w := 0
1	w := 0	|w| > e	w := signw * e
w > e	w := 0	w > e	w := e

Figure 10. Substitution corresponding to a barrier

1   substitution condition
2   substitution

With a search for extremal values, the component of the resultant row c[j] is
sought, whose value fulfills the search conditions. The following search condi-
tions are possible:

$$|w| = \min |value\ c[j]|$$
$$w = \min (value\ c[j])$$
$$|w| = \max |value\ c[j]|$$
$$w = \max (value\ c[j])$$

Option 3 is effective only when an indexed resultant row is generated. If option 3
is chosen, the resultant components, whose values are to be calculated explicitly,
are also stored explicitly (i.e. also components with the value zero).

With option 4, that component c[X] of the resultant row is sought, which is associ-
ated with the index X (contained in DW1 of PAB).

In DW0 of the PAB, internal parameters can be specified for processing the operands
as well as the mask bit MASK and the continuation bit FORT for handling algorithmic
exception conditions.

2.4 Message Block MIB

In the message block MIB, more detailed information is given to the user in the
case of a regular end of operation (condition code CC = 0) or in the case of an
irregular termination (CC = 1, 2). The structure of the MIB for CC = 0 is given
in Figure 11.
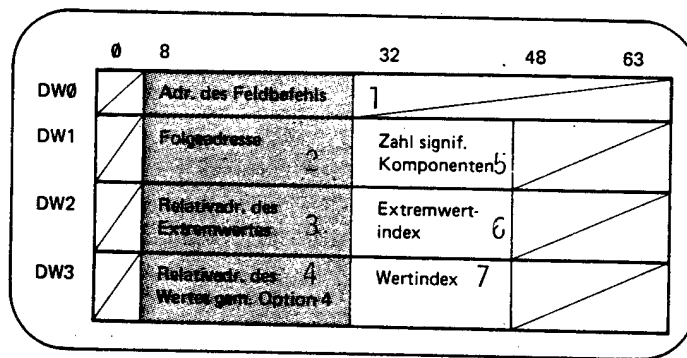
Figure 11. Message block MIB

1 address of field instruction
2 following address
3 relative address of the extreme value
4 relative address of the value according to option
5 number of significant components
6 extreme value index
7 value index

In DWØ, the address of that field instruction is specified, to which the MIB refers. The follower address specified in DW1 points to the next free double word address after the resultant row c. The number of significant components, in the case of an indexed resultant row c, contains the number of explicitly stored components. In the case of a non-indexed resultant row c, it contains the number of components of c whose value is not equal to zero. In DW2 are contained specifications for option 2, and in DW3 are contained specifications for option 4. The specified relative addresses generally refer to the Adr. c of the resultant row.

An irregular termination of a field instruction can occur through the appearance of an algorithmic exception condition (Figure 12). Here, a continuation is possible with the message CC = 1. Through the continuation bit FORT, contained in the PAB, it is possible to specify whether it is intended to continue. With the message CC = 2, continuation is not possible.

With the mask bit MASK contained in the PAB, the report of certain algorithmic exception conditions can be suppressed. Depending on the exception that has occurred, an entry will be made in the MIB.

In DW1 (Figure 13), specifications are given concerning the kind of algorithmic exception condition as well as references regarding the context (index, row number), through which the exception has been caused.

Figure 12. Algorithmic exception conditions

Type of exception	CC	Explanation
IP	2	Unallowable parameter input in the PAB
NM	2	In an indexed row, the indices do not form a monotonically increasing sequence
SO	1	An attempt was made to write a component of the resultant row at an address which is specified by the protection address PA in the PAB
EOA	2	Exponent overflow during addition, of mantissa = 0, characteristic > 128
EUA	1	Exponent overflow during addition, i.e. mantissa = 0, characteristic < 0
LS	1	Mantissa lost during addition, i.e. mantissa = 0

Figure 13. Type of algorithmic exception conditions

	0	8	24	32	48	63
DW0		type of field instruction				
DW1		type of exception	source of the exception	index	row number	

Mnemonic	Designation	Subcode	Short Description
	Row manipulations		
TER	Test row	85	testing the components $a[X], a[X+1],.., a[Sa-1]$
RSTR	Restore row	A1	$c[j] := a[j+X]$ $(j = 0,1,..., Sa-1-X)$
URR	Unite row and row	C1	$c[j] := \begin{cases} b[j] & \text{für } j < X \\ a[j-X] & \text{für } j \geq X \end{cases}$ $(j = 0,1,.., Sa-1+X)$
	Row operations		
ARR	Add row and row	D7	$c[j] := a[j] + b[j]$ $(j = 0, 1,.., \max(Sa, Sb) -1)$
ARC	Add row and constant	DE	$c[j] := a[j] + b[0]$ $(j = 0, 1,.., Sa-1)$
MRS	Multiply row by row	C4	$c[j] := d * a[j]$ $(j = 0,1,.., Sa-1)$
MRSAR	Multiply row by scalar and add row	E7	$c[j] := d * a[j] + b[j]$ $(j = 0,1,.., \max(Sa, Sb) -1)$
MRSARX	Multiply row by scalar and add row from index X	F7	$c[j] := \begin{cases} b[j] & \text{für } j < X \\ d*a[j] + b[j] & \text{für } j \geq X \end{cases}$ $(j = 0,1,.., \max(Sa, Sb) -1)$
MRR	Multiply row by row	C7	$c[j] := a[j] * b[j]$ $(j = 0,1,.., Sa-1)$
MR1	Multiply row by itself	A7	$c[j] := a[j] * abs(a[j])$ $(j = 0,1,.., Sa-1)$
	Field manipulations		
FRAC1	Form row from array components with given index	A3	$c[j] := A[j, SA-1]$ $(j = 0,1,.., R-1)$
FRACD	Form row from array components in principal diagonal	AA	$c[j] := A[j,j]$ $(j = 0,1,.., \min(R,SA)-1)$
EARRVI	Exchange in array rows row values according to indices	A9	$A[j,i] := \begin{cases} A[j,i] & \text{für } i \neq X, i \neq SA-1 \\ A[j,X] & \text{für } i=SA-1 \\ A[j,SA-1] & \text{für } i=X \end{cases}$ $(j = 0,1,.., R-1)$
ZAVI	Zero array values with given index	89	$A[j,i] := \begin{cases} A[j,i] & \text{für } i \neq SA-1 \\ 0 & \text{für } i=SA-1 \end{cases}$ $(j = 0,1,.., R-1)$

Mnemonic	Designation	Subcode	Short Description

Field operations

SMARR	Scalar multiply array row by row	C2	$$c[j] := \sum_{i=\emptyset}^{\min(SA,Sb)-1} A[j,i]*b[i]$$ $(j = \emptyset,1,..,R-1)$
SMARI	Scalar multiply array rows by itself	A6	$$c[j] := \sum_{i=\emptyset}^{SA-1} A[j,i]*abs(A[j,i])$$ $(j = \emptyset,1,..,R-1)$
SRVAR	Sum row values for array rows	B2	$$c[j] := \sum_{i=0}^{SA-1} A[j,i]$$ $(j = \emptyset,1,..,R-1)$
LCARR	Linearly combine array rows according to row components	E8	$$c[j] := \sum_{i=\emptyset}^{\min(R,Sb)-1} A[i,j]*b[i]$$ $(j = \emptyset,1,..,SA-1)$
SAR	Sum array rows	C8	$$c[j] := \sum_{i=\emptyset}^{R-1} A[i,j]$$ $(j = \emptyset,1,..,SA-1)$
SAVD	Sum values in principal diagonal	BA	$$c[\emptyset] := \sum_{i=\emptyset}^{\min(R,SA)-1} A[i,i]$$

Calculation of polynomials

CPRV	Calculate polynomial for row values	CE	$$c[j] := \sum_{i=\emptyset}^{Sb-1} b[i]*a[j]\exp(Sb-1-i)$$ $(j = \emptyset,1,..,Sa-1)$

Correlation

COR	Correlation	CF	$$c[j] := \sum_{i=\emptyset}^{\min(Sa-j,Sb)-1} b[i]*a[j+i]$$ $(j = \emptyset,1,..,Sa-1)$
AC	Autocorrelation	AF	$$c[j] := \sum_{i=\emptyset}^{Sa-j-1} a[i]*a[j+i]$$ $(j = \emptyset,1,..,Sa-1)$
CCR	Cyclic correlation	DF	$$c[j] := \begin{cases} \sum_{i=\emptyset}^{s-1} b[i]*a[j+i] & \text{if } s\leqslant Sa-j \\ \sum_{i=\emptyset}^{Sa-j-1} b[i]*a[j+i] + \sum_{i=Sa-j}^{s-1} b[i]*a[j+i-Sa], & \text{if } s > Sa-j \end{cases}$$ $(j = \emptyset,1,..,Sa-1), s = \min(Sa,Sb)$

Mnemonic	Designation	Subcode	Short Description
	FFT, Complex Operations		
FFT	Fast Fourier Transformation	CD	Fast Fourier Transform of the row a into the row c (Sa = 2exp m compl. component) after the algorithm of COOLEY TUKEY
FFTI	Fast Fourier Transformation inverse	DD	
RAFC	Rearrange Fourier coefficients	CC	Rearranging the row a, generated with FFT/FFTI, into the row c, multiplying by the scalar d (Sa = 2 exp m complex comp.)
MRCC	Multiply row by row, complex	C6	$c[j]: = a[j] * b[j]$ (complex) $(j = 0, 1,...$ Sa-1; Sa = k*32 compl. comp.)

Figure 14. List of MAMO field instructions (continued from previous two pages)

3. Instruction Spectrum

3.1 List of MAMO Instructions

This list (Figure 14) carries the defined field instructions of the operation code X'E1'. An extension of the instruction list is possible conditionally within the framework of the implemented device technology, through the flexibility of the microprogram control.

3.2 Simple Demonstration Examples

Example 1 (Figure 15): Addition and multiplication of matrices
$D = A*B + \lambda*C$
A   (Sa,Sb)-matrix
B   (Sb,R)-matrix
b_i ith column of B
C   (Sa,R)-matrix
c_i ith column of C
D   (Sa,R)-matrix
d_i ith column of D
$(i = 0,1....R-1)$
λ scalar factor

A,B,C,D - stored by columns.

$i := 0$

$p := LCARRC(A, b_i)$ 3 $p \ldots Sa\text{-}Vektor\ (Zwischen\text{-}speicherbereich)$ $p := A * b_i$

$CC = 0?$ n 6 → Fehler 4

$d_j := MRSAR(C_i, p, \lambda)$ $d_j := \lambda * c_i * p$

$CC = 0?$ n → Fehler

$i = R-1?$ j → Ende 9

$i := i+1$

PAB für LCARRC aktualisieren (Adr b_i) 1   Aktualisieren der Adressen in den Parameterblöcken 5

PAB für MRSAR aktualisieren (Adr c_i, d_j) 2

$CC \sim Bedingungscode$ 8
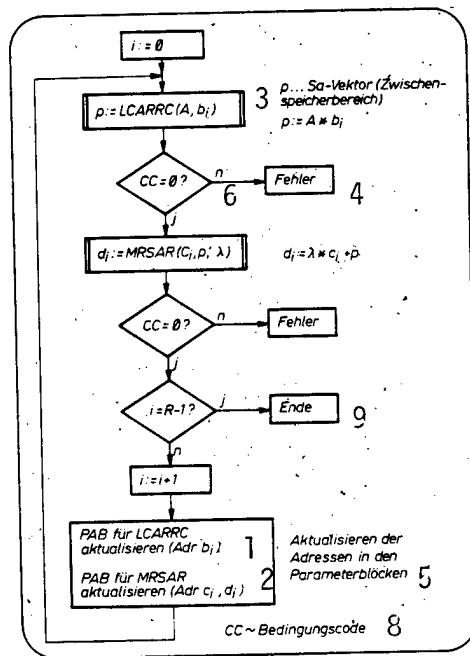
Figure 15. Addition and multiplication of matrices

1   PAB for LCARRC updated (Adr, bj)
2   PAB for MRSAR updated (Adr, cj,dj)
3   p..Sa vector (intermediate storage region)
4   error
5   updating the addresses in the parameter blocks
6   no
7   yes
8   condition code
9   end

Example 2 (Figure 16): Iteration $X^{(k+1)} = A*X^{(k)}, X^{(0)} = X$; terminates if
$\max_i |X_i^{(k+1)} - X_i^{(k)}| < e$
(e ... barrier)
A...(R,R)-matrix
$X, X^{(k)}$...R-vector
A - stored by rows.

Example 3 (Figure 17): Folding of two rows a, b by means of the Fast Fourier Transform (FFT).
$c = f(a,b)$ a, b, c - rows with $Sa = sB = Sc = 2^m$ components

In the program execution sequence diagrams for the examples, MAMO instructions are identified by ⊓⊓⊓.

Other activities are implemented through CPU instructions.
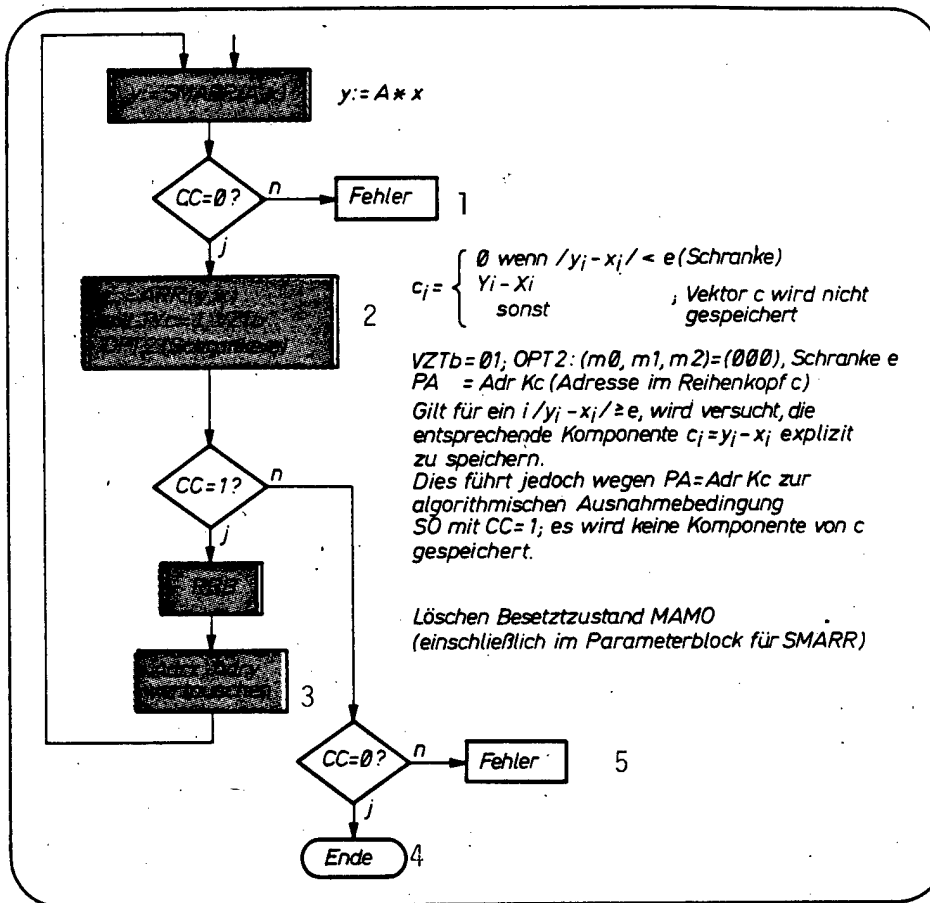
Figure 16.   Iteration with termination

1   error
2   c: = ARR(y,x) with TYc = 1, VZTb -OPT2 (barrier e)
3   Adrx, Adry interchanged
4   end
5   error

$$c_i = \begin{cases} 0 & \text{if } /yi - xi/ \quad e \text{ (barrier)} \\ Yi - Xi & \text{otherwise vector c is not stored} \end{cases}$$

VZTb = 01; OPT 2: (m0, m1, m2) = (000), barrier e
PA = Adr Kc (address in row head c)

Holds for an i/yi - xi/ _ e, an attempt is made to store the corresponding
component ci = yi - xi explicitly.

However, because PA = Adr Kc, this leads to an algorithmic exception condition
SO with CC = 1; no component of c is stored.
Erase occupation status MAMO (including in parameter block for SMARR).

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c:=FFT(a) Transformation der Reihe a 2

CC=0? n Fehler 1

c*:=FFT(b) Transformation der Reihe b 3
(Reihe c* mit 2^m Komponen-
ten, Zwischenspeicherbereich)

CC=0? n Fehler

c:=MRRC(c,c*) Komplexe Multiplikation 4
im Bildbereich

CC=0? n Fehler

c*:=RAFC(c,1) 5 Umsortieren der Fourier-
Koeffizienten

CC=0? n Fehler

c*:=FFTI(c*) 6 inverse Transformation

CC=0? n Fehler

c:=RAFC(c*,d) 7 Umsortieren der Resultats-
komponenten, Multiplikation
mit dem Normierungsfaktor d

CC=0? n Fehler

Ende

Figure 17. Folding of two rows a, b with the Fast Fourier Transform (FFT)

1   error
2   transformation of row a
3   transformation of row b (row c* with 2^m components, intermediate storage area)
4   complex multiplication in the image area
5   resorting the Fourier coefficients
6   inverse transformation
7   resorting the result components, multiplication with the normalization factor d

3.3 MAMO Instruction Times and Performance Comparison

Because of the manifold parameter influences on MAMO instruction times, an absolute performance specification is inappropriate. Studies have shown that the performance capability of MAMO becomes important beginning at row lengths of about 30.

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Figure 18 lists a few instruction times and performance comparisons with corresponding assembler programs (calculated on the CE 2655). Here, examples have been chosen which have considerable importance in application.

| Befehl [1] | Sa | Sb | wesentliche Parameter [2] Formate [4] | | Befehlszeit [5] t_M/ns | Faktor [6] t_{ZE}/t_M |
			Faktoren [3]	Summ.		
ARR	64	64	–	K	0,15	7
ARR	512	256	–	K	0,6	17
MRSARX	512	384	K	L	0,7	29
m. Extrem-wertsuche [7]						
MRSARX	512	384	L	L	1,2	12
SMARR	64	64	K	K	0,17	9
einreihig [8]						
SMARR	512	512	K	L	0,5	20
einreihig						
CPRV [8]	512	16	K	L	4,0	35
COR	4096	4096	K	K	4100	40
FFT	64	K Komplex			1,2	35
FFT	2048	K Komplex			40	65

t_M: MAMO-Befehlszeit [9]
t_{ZE}: Zeit eines adäquaten Assemblerprogramms, gerechnet auf ZE 2655 [10]
Sa/Sb: Schrittzahlen der Reihen a/b [11]
K/L: Formate kurz/lang [12]

Figure 18. Instruction times and power comparison with the assembler programs (calculated on the CPU EC 2655)

1   instruction
2   essential parameter
3   factors
4   format
5   instruction time
6   factor
7   with extremal value search
8   one-row
9   MAMO instruction time
10 time of an adequate assembler program, calculated on the CPU 2655
11 number of steps of rows a/b
12 format short/long

4.   Global Characteristics of MAMO

4.1 Block Structure

In Figure 19, the MAMO is subdivided into its most important logical complexes. This yields the following groups of complexes:

Central Diagnostic Complex (ZDK):

The ZDK is directly linked with the error response system FMS of the CPU, but sometimes operates completely autonomously. The component interface 3 contains

a special command section, where elementary control commands are transferred to the ZDK from the CPU and from the EC 7069M/EC 7069. Through this connection, the ZDK, within the framework of its wide functional scope, can be completely programmed externally. This basic property, in combination with the novel orthogonal data shift device "diagnostic bus", is a precondition for the extraordinarily good servicing and diagnostic properties of the MAMO. The ZDK does no preprocessing in the sense of the MAMO algorithms.
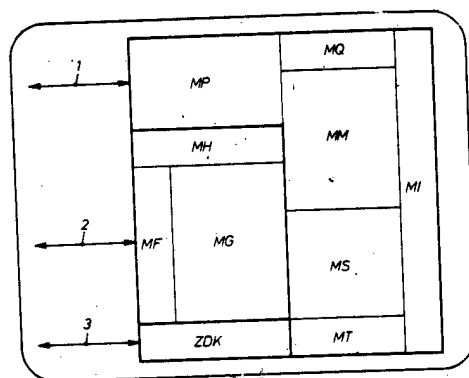

Figure 19. MAMO block structure

Microprogram-Controlled Function Complexes:

MG: MG is the microprogram control unit. By means of it, the following functions are executed:

Controlling the execution sequences in the MH to generate the necessary address calculations for all MS accesses of the buffer and for special control accesses (dynamical microprogram loading).

Controlling the interface procedures of the MF.

Presetting and starting the slave-controlled automatic units.

Evaluating the current operating conditions of the working automatic units.

MF: Implementing the procedures on component interface 2.

MH: Address computing unit for communication between the MAMO and MS.

Logically Controlled Complex

This consists of six rather large logic units which, in conjunction with one another, perform a type of "hand shake" operation. MQ, MM, MS and MT form the processing pipeline, which is controlled by the control unit MI.

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MP: The buffer consists of eight blocks, each with 32 double words. The blocks are used dynamically, in alternation as input/output buffers, and work essentially in parallel. Supply accesses of the pipeline and MS traffic are first of all parallelized.

MQ: Data selection control of the pipeline from the buffer.

MM: Multiplication unit

MS: Addition unit

MT: Test unit

MI: Index control unit, which supplies the control "tupel" to the automatic pipeline units.

Figure 20 shows, in stylized fashion, the control levels in the EC 2655/EC 2655M. It is apparent that four control levels become active for processing MAMO tasks; here, a parallelization of the functions sometimes affords considerable performance gains.

4.2 Execution Sequence of a MAMO Field Instruction from the User Perspective

In Figure 21, an attempt has been made to represent in a block diagram the most important activities involved with the execution of a MAMO field instruction.

Block A: Designates a CPU program, which, up to this point, has not yet processed a MAMO field instruction.

Block B: With the decoding of the E1 operation code, represents the beginning of the MAMO field instruction. This function occurs in the instruction preparation unit of the CPU.

Block C: Represents a CPU microprogram which is activated by the E1 instruction code. Its tasks are:

testing the validity of the subcode,
where appropriate, generating the standard program exceptions PRAN (1),
testing the MAMO conditions READY, BUSY, BLOCKED, switching on the MAMO mode,
transfer of the valid subcode to the MAMO and MAMO start.

This CPU microprogram (C) subsequently goes into a special waiting status, where it waits for a message from the MAMO.

In Block D, MAMO processes the desired algorithm. If, during execution of the algorithm, I/O interrupts occur in the CPU because of the MAMO, or if external interrupts occur, or other conditions which require immediate handling by the CPU, a halt request (2) is transmitted from the CPU control to the MAMO.

Thereupon the MAMO terminates its MS access activities, goes over into the busy state, and reports with a halt message (3) to a CPU microprogram, which is represented by block E. This microprogram initiates an operation end of the MAMO

instruction. Subsequently, the CPU handles the interrupt through the activity 4. The activity 3 also occurs, if, during the processing of the algorithm, algorithmic exceptions occur or, during data acquisition by the MAMO access exceptions occur in the MS.

If no halt request exists or if no interrupt exists in the CPU upon termination of the CPU microprogram block E, the next CPU instruction of the active MAMO program is called, which must be a conditional transfer instruction (Block F).

If CC = 0, the program is continued with the following instruction, which can already again be a MAMO instruction (Block G).

If CC ≠ 0, there is a transfer to a connection routine (Block I), which is generated when the macro statement MPB (see Section 6.1) is first called, together with the parameter block PAB.

The connection routine establishes the connection to the PRAN handling routine of the user (Block H). The address of the handling routine is located in the parameter block PAB. This principle guarantees that the user can assign his own PRAN handling routine to each group of MAMO field instructions or to an entire MAMO program.

If the PRAN handling routines were able to make good the program damage, a transfer (9) occurs to Block 9, and there the instruction counter status of the interrupted MAMO instruction is reestablished, and a transfer takes place to this instruction (11).

If the PRAN handling routine does not succeed in its task, the activity is returned to the operating system with a program end SVC instruction (8). In the ABEND routine of the control program, the BUSY status of the MAMO is cancelled with the instruction MUC. If no PRAN handling routine has been provided when CC = 1 occurs, the connection routine takes care of the transfer 8 to the operating system. The special treatment of the arithmetic exception in the case of MAMO field instructions leads to a significant speed-up of this procedure, since the path via the operating system is avoided. In the processing of data fields, the PRAN handling can occur with great frequency (e.g. loss of mantissa, exponent underflow). A repair possibility in this case consists in the fact that the corresponding resultant components are replaced by true zeroes.

4.3 Servicing and Diagnostics

The MAMO is serviced through the operating unit EC 7069 or the BSP EC 7069M. The individual functional units of the MAMO are functionally displayed through special servicing pictures.

The most important registers, counters, control triggers are displayed in standard form. Every MAMO service picture contains a variable section in the lower picture area, through which one can display every further MAMO trigger through a certain display address. Since the MAMO has available an orthogonal data shift device, namely the diagnose bus, all MAMO triggers can be set to an arbitrarily selectable value for test purposes, in pulsed cycle or pulse phase operation. All these manipulations take place from the servicing unit or from the BSP.
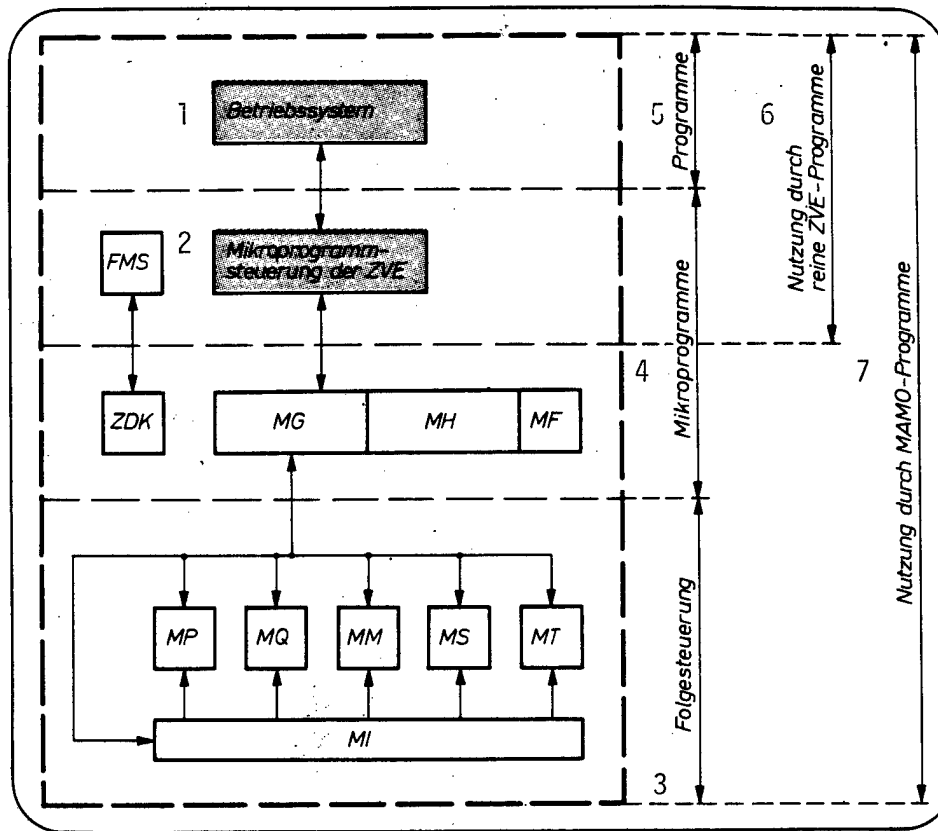
Figure 20. Control levels

1   operating system
2   microprogram control of the CPU
3   follow-up control
4   microprograms
5   programs
6   utilization by pure CPU programs
7   utilization by MAMO programs

In the above-mentioned pulse control modes, all MAMO-RAM storage locations can also be indicated and written on.

The above characteristics are the basis of the implemented testing means. The test is mainly done by:

Microtest 1 (MT1)

A CPU microprogram packet externally tests the CPU/MAMO interface and several basic functions, which are essentially used for communication between the CPU and the MAMO within the subsequent tests.

Microtest 2 (MT2)

MAMO test microprograms test the MAMO by functional units according to the principle of building-up tests.

Both test groups run under the control of the microtest monitor. The test programs work by building on the basis tests MT1 and MT2. Their main purpose is to check agreement of the MAMO function with the prescriptions of the MAMO operation principles and furthermore to supplement the testing stringency of the basic tests.

5. Preconditions for Operating the MAMO in the OS/ES

5.1 Logical Microprogram Memory LMPS, LTMPS

LMPS:

The MAMO has its own microprogram control unit.

Besides an ROM memory, which controls 32 microinstructions, all the remaining microprograms are located in a storage region (LMPS), which is situated at the end of the MS.

The MAMO uses its own RAM microprogram buffer with a capacity of 512 microinstructions (four bytes each). About the first 200 microinstructions form the core section, which is necessary to process all the algorithms. This microprogram core is loaded only once within the MAMO-IPL from the LMPS into the microprogram buffer. Then the MAMO is in the READY state.

If a defined subcode is transmitted to the MAMO, it will load the corresponding microprogram from the LMPS into the residual loadable part of the buffer. The loadable parts are called variable complexes and, with an LMPS version, they always have a constant length, i.e. 512 microinstructions minus the length of the core microprogram.

Up to eight algorithms are stored in a variable complex. A microprogram belonging to a subcode can be contained in several variable complexes, so as to save reloading time during certain instruction sequences in certain user programs. In order to communicate to the MAMO which subcodes are implemented by the microprograms contained in the variable complex, a subcode index with a length of two double words is chained to each variable complex. This subcode index is loaded by the MAMO in a small RAM memory. With further MAMO instruction steps, the MAMO checks whether the microprogram for the newly started MAMO field instruction is already contained in the loaded variable complex. If such is not the case, the MAMO loads the required variable complex automatically from the LMPS into its microprogram buffer.
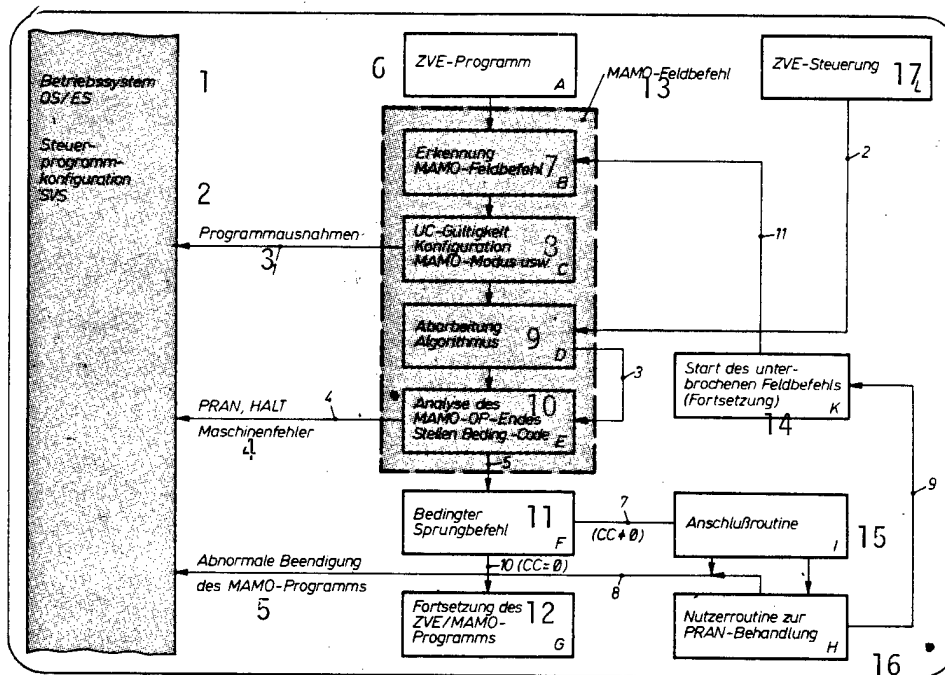
Figure 21. Most important activities when executing a MAMO field instruction

1   operating system OS/ES
2   control program configuration SVS
3   program exceptions
4   PRAN, halt machine errors
5   abnormal termination of the MAMO program
6   CPU programs
7   detection of the MAMO field instruction
8   UC validity, configuration, MAMO mode, etc.
9   processing algorithm
10   analysis of the MAMO-OP end position condition code
11   conditional transfer instruction
12   continuation of the CPU/MAMO program
13   MAMO field instruction
14   start of the interrupted field instruction (continuation)
15   connection routines
16   user routines for PRAN handling
17   CPU control

In order to control reliably the transfer processes of the LMPS file from an external data medium into the MS, all the data of the LMPS are added in double word fashion in a certain manner. The resulting sum is complemented and is entered in the LMPS at a certain address position. The CPU has microprograms which can be addressed partly automatically, and partly through the MAMO instruction LSM. These are capable of executing a test addition with the same algorithm. After a test addition, a 64 bit unit vector must be generated as the test sum through the LMPS content so that the entire LMPS is accepted as error free.

Figure 22. Representation of the condition code at the operation end of a MAMO
instruction by the microprogram, block E

CC Meaning

0   MAMO field instruction algorithm has been completely processed in the regular
    manner.
    The MAMO is ready to execute a new MAMO instruction
1   The algorithm was interrupted in its execution by an event
    The MAMO is busy and its algorithm can be continued at any time
2   The algorithm cannot be executed because of certain events
    The MAMO is not busy and is ready to execute a new MAMO instruction
3   Forbidden condition code

A slightly modified method is also used to test the steady microprogram loading processes between the LMPS and the MAMO microprogram buffer. If a test sum error occurs in the MAMO, the MAMO execution sequence is interrupted, and a message is sent to the CPU. The above-mentioned CPU test program then checks the LMPS in the MS. If it is okay, the MAMO is reported as being free of error. If the LMPS is defective, without the ECC equipment having responded, a machine error, generated by the microprogram, is reported.

LTMPS (Logical Test Microprogram Storage):

Also at the end of the HS, behind the LMPS file, is situated a region which is used for testing the MAMO.

This region contains:

loadable MAMO test microprograms
loadable CPU microprograms
test data, theoretical data
logout/login region
control tables for finding the individual files

The microtest philosophy of the MAMO provides that the entire test organization is executed by a microprogram CPU-MAMO test monitor. This test monitor is a component of the CPU microtest complex.

The tasks of the test monitor are the following:

Starting the individual test steps in the MAMO
Supplying the test steps with the special test and theoretical data
Theoretical/actual comparison after each test step and entry of the test results,
in the case of an error, into the diagnostic buffer of the CPU.

5.2 MAMO-IPL

The MAMO-IPL program is a system-independent program for initializing the MAMO. The
operating system support for the MAMO presupposes that, at the time the operating
system is initialized, the MAMO is already functional. This means that it is capable
of executing MAMO instructions in conjunction with an LMPS that is already located
in the MS, and that, in conjunction with a likewise already loaded LTMPS, the MAMO
microtest is ready to operate.

This operational readiness of the MAMO is produced by the MAMO-IPL program. It
works system-independent and is executed before the start of operating system
initialization. The self loading program MAMO-IPL takes care of loading the files
LMPS and LTMPS from tape into the upper address region of the MS, and of initializing
the MAMO.

Before the microprogram core-loading and the MAMO-READY switch-on can take place,
the program performs, among other things, test-sum checks for the LMPS and LTMPS
as well as a complete microtest in the CPU and the MAMO. After the MAMO-IPL program
has terminated, the MAMO has the status "READY", "BLOCKED", and "NOT BUSY". The
subsequent operating system IPL may be executed only with "IPL without erasing MS",
so that the loaded files LMPS and LTMPS are not destroyed.

5.3 Control Instructions

The algorithms cited in Point 3.1 are only that part of the function which are
exclusively oriented towards the problem solution of the user. So as to support
the MAMO effectively in the operating system, the following six privileged control
instructions have been created:

MUC: (MAMO USING CONTROL)

This instruction is used by the operating system to allow or to prohibit a problem
program the use of the MAMO. The instruction also runs if a MAMO has not been
configured in.

MST: (MAMO STATUS TEST)

This instruction uses the operating system to ascertain the usability of the MAMO.

LSM: (LOAD STATUS MAMO)

This instruction has a similarly far reaching significance for the MAMO as the
diagnostic instruction has for the universal processor. It is used both for the
operating system and also by the autonomous test programs. The instruction func-
tion is specified by a special parameter block. A few functions may be mentioned
here:

"CORE LOADING" (IPL program)
LMPS/LTMPS sum check
login/logout
data transfer between LMPS/LTMPS region and the MS section used by the operating system
activation of arbitrary MAMO microinstructions, etc.

SMC: (SET MAMO COUNTER)

By means of this instruction, the operating system loads the MAMO counter, which, in a MAMO program, counts the number of MAMO instruction starts. The MAMO counter also continues to count when an interrupted MAMO instruction is continued.

SMT: (SET MAMO TIMER)

This instruction permits the operating system to preset the MAMO clock.

MMC: (MAMO MONITOR CALL)

By means of this instruction, the operating system causes the MAMO to report back to the operating system after it has completely processed the algorithm. This is done with a MONITOR CALL interrupt. In this way, a MAMO program of higher priority can be started.

In addition to these six privileged instructions, there are also three non-privileged control instructions:

STMC: (STORE MAMO COUNTER)

By means of this instruction, the user also can interrogate the number of MAMO instruction starts that have been executed in the program up to this time, so as to obtain information concerning the degree of influence of interrupts on MAMO performance.

STMT: (STORE MAMO TIMER)

Through this instruction, the problem program measures the pure MAMO time fraction in his program. For the operating system, this is used for billing purposes. Furthermore, the authorized problem program can ascertain whether the MAMO is busy.

RBB: (RESET BUSY BIT)

By means of this instruction, an authorized problem program can cancel the BUSY status, if it is impossible actually to continue the MAMO instruction after a continuable program exception.

6.   Operating System Support

6.1 Support of the Programming of MAMO Problems

The MAMO is currently programmed in assembler language. By means of special assembler macros, work with the message block MIB is facilitated. The required

macro definitions are contained in the system library SYSS1.MACLIB.

The macro statements for the memory instructions are coded during programming like CPU instructions of the SS format, using the mnenomic instruction codes. The operand addresses point to the MIB and the PAB. By means of the macro MPB, the parameter block PAB is generated, and by means of the macro MIB, the message block MIB is generated. So that an already existing parameter block can continue to be used for subsequent MAMO field instructions, the macro MPB makes it possible to modify its content. The analogous procedure is made possible for the message block MIB by means of the macro MIB.

So that the MAMO can also be used in programs which are written in the higher pro-gramming languages FORTRAN, COBOL or PL/1, the respective connection macros must be used, so that the MAMO assembler routines can be integrated into the particular program unit.

6.2 Functions in the Control Program

The support of the MAMO in the EC-1055/EC-1055M configuration is effected generatably in the control program configuration SVS of the OS/ES. The control program configu-ration SVS permits adequately reliable protection against intentional or uninten-tional damage of the control files LMPS and LTMPS by problem programs. These control files are of life and death importance for the MAMO process in the system and they are situated at the end region of the MS. This property is achieved in virtue of the fact that the page frame table generated in the system initialization process does not contain the pages of the control data region at the end of the MS.

As a result of concealed machine errors, these protective measures may nevertheless become ineffective. Consequently, with dynamical microprogram loading processes, the sum tests are always performed with every transmission process, and thus such a false influence is detected.

On the part of the operating system, the MAMO field instructions are set equivalent to CPU instructions as regards their applicability. The control program assigns the MAMO to jobs running in the system according to similar criteria as are gener-ally applicable for job selection. If the MAMO is not busy, and if a field instruc-tion is called, it is assigned to the active job. This assignment takes place at least for the duration of one MAMO field instruction, since the MAMO is left behind in a not busy state only after completion of the instruction with CC = $\emptyset$, 2. As regards CC = 1, what has been said under Point 4.2 is applicable.

Multiprogram operation of MAMO jobs

The multiprogram operation of the MAMO is implemented with a specially created auxiliary means, the BLOCKED mode.

So that MAMO programs can be taken into account in accord with their priority, it is first of all important to inform the operating system of their appearance within the system, so that the new MAMO job can be placed in the queue in accord with its priority.

Since MAMO jobs do not differ externally from pure CPU jobs, a means must be found which allows MAMO utilization only to jobs authorized by the operating system. The BLOCKED mode represents such a means.

Its function is the following:

After the EC 2655 or the EC 2655M is switched on, the MAMO BLOCKED mode is switched on. Every attempt by a program to address the MAMO with a non-privileged MAMO instruction leads to an operation exception.

If the MAMO operating system support has been generated, the operation code of the instruction initiating the problem exception is analyzed. If the operation code is "E1" and the MAMO is in the READY status (see MAMO-IPL), the BLOCKED mode is switched off by means of the MAMO control instruction MUC. If the MAMO is in the NOT BUSY status, the corresponding job is immediately restarted. The current PSW now has free access to the MAMO during the running time of the program. If this job is interrupted, the MAMO can immediately again be placed into the BLOCKED mode through the control program by means of MUC.

Every MAMO program first begins with an operation exception during its first attempt to use the MAMO. In this way, the MAMO program is recognized as such by the control program.

So that a MAMO program which occupies the MAMO can be caused to give up control in favor of a MAMO program of higher priority, after the first program has completed the current MAMO field instruction, a MAMO-RUF trigger is switched on by the control program by means of the MAMO control instruction MMC. If a MAMO field instruction completes operation without leaving behind the MAMO in the BUSY state, and if the MAMO-RUF trigger is switched on, a MAMO call interrupt is initiated, which leads to immediate activation of the MAMO program with priority.

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CSO: 2302/4

TECHNICAL DEVELOPMENT POLICY, FUND ALLOCATIONS EXPLAINED

Budapest NEPSZABADSAG in Hungarian 7 Jul 82 p 10

[Interview with National Technological Development Commission deputy chairman Istvan Muller by Katalin Bossanyi, date and place not specified; "On Central Technical Development"]

[Text] For a long time, we have been devoting 3 percent of our annual national income to research and development (R & D) purposes. However, it seems this yearly investment is not in agreement with actual or potential results. Since the pace of economic growth has slowed, understandably less money is turned towards technical development. At the same time, changes in international commodity exchange rates necessitate more rapid modernization of technology and the productive structure. In this situation, we can predict for many future years how well we will be able to concentrate our financial and mental resources and what central orientation we will provide to enterprises in choosing their newer technological development directions. This task and responsibility falls mainly to the National Technological Development Commission [NTDC]. We spoke with deputy chairman Istvan Muller concerning the management functions of the NTDC, incentives for technical development, and possibilities for further extension.

Support for the Main Directions

[Question] A predetermined part of the technical development fund of industrial enterprises is centralized, and it is divided by the NTDC and industrial ministries. How do you administer this substantial development sum?

[Answer] In this plan period, the NTDC is working with a 9 million forint technical development fund. We support certain state-of-the-art technological developments or licensing procedures having them pay back only part of these funds or by offering the industries interest-free loans. In our experience, this increases the enterprises' incentive to accelerate technical development and to select the most economical solutions. This also increases the NTDC's risk--thus giving it the role of partner in the enterprise--because if we finance an unsuccessful development, then as a result our own support possibilities are decreased. Ten percent of the over 9 million forints represents a required reserve, which is maintained by the National Science Policy Committee for unexpected, urgent needs, such as the most pressing areas in the "technological

gap" between highly industrialized countries and moderately developed ones. The subsidized areas can be divided into three main categories. In the first belong the 14 medium-term research-development projects: in the Sixth Five-Year Plan, we will provide them with 3.5 million forints. The ministry programs will receive 2.8 million forints, and the remaining 20 percent is to be managed at our own discretion.

[Question] Are these internal ratios proper? It seems that what will be financed has been predetermined for many coming years.

[Answer] Without a doubt, this medium-range program seems excessive. But it is also true that the program is not only beneficial for one or two areas of enterprise or branches of industry, but for maintenance and strengthening of the competitive edge of the entire national economy as well. For example, I will mention energy conservation, machine production technology, support industries, microelectronics, original pharmaceutical research, pesticide programs, modernization of grain output and increasing protein production as targets of the program. It would be very difficult to select priorities or to rank them. However, I still feel that no matter how painful it may be for certain areas, further reductions in research-development programs are necessary. We must focus more on the few areas in which we already have the necessities for development, in which investment is worthwhile even in these capital-deficient times, and which serve long-range industrial policies and daily market interests equally well.

Inspection of the System

[Question] What business pursuits do you support? That is, in enterprise development programs, how is technical development supervised to benefit national economic interests?

[Answer] We select among the business technical development recommendations and requests on a competitive basis. In addition, we also initiate domestic use of research and development of new procedures. We strive to finance only those endeavors which represent technological advances and are advantageous to more than one enterprise. This is still valid if only a few enterprises receive the support. Central technical development, support or loans are comprehensive, trying to take in entire segments of technology. However, we can often support the purchase of only the most important components of the technological chain, sometimes because these are the most difficult for the enterprises to obtain, or because in this way we encourage them towards large-scale technological thought. This process is full of conflict, however. Occasionally, due to interim economic changes, funds become inadequate for the purchase of additional machinery, and thus "development islands" are formed. Yet an even greater worry is that joint ventures among enterprises are still chancy, although without them, a well-reasoned technical development policy is inconceivable.

[Question] Many regard the central technical development loans as "easy" money, since they come not from the strained development base, but from tax-exempt technical development funds. How are conditions for NTDC loans being tightened?

[Answer] I feel that technical development funds should be the most solid money, since our future is in question. All over the world, developmental breakthroughs serve as strategic steps, and the money used to support them is most often subsidized, for short-range market or economic reasons. However, this does not mean that the NTDC does not screen strictly the goals it chooses to support. In the past 2 years, some enterprises have been required to contribute to the financing of their technical development concepts; in our experience, this increases the collective interest. A business order is a requirement for central support to research institutes or university departments. Yet we do not want to perform a traditional bank role, either in drawing up the stipulations for loans or awarding them.

[Question] Then further restrictions are not necessary?

[Answer] Yes they are. Nonetheless, I will reverse the question: why should we further restrict financial conditions for technical development, when forced economic measures are already inhibiting technical advancement? Industrialized countries generally also offer state support, for example through tax benefits, to technical development projects which renew the productive structure or help catch up with technology. Here, however, the cost burden of some truly modern, technical-technological changes can so affect an otherwise technologically marketable product that a marketable price is no longer insured. Of course, slow and disorganized implementation also plays a part. Yet the limits of our methods stand out in how slowly technical development is taking place. Some enterprises "research" for many years just so they will not have to add a key machines, so necessary for production, to their fixed assets and thus burden their developmental base further. I myself have worked as both an enterprise and a ministerial director. Even with this experience, I can only say that on an every day basis, technical development and investment are not—indeed cannot be—separated as much as financial regulations require. More flexibility is necessary here, as well as more trust in the enterprise.

However, I do agree that more effective central orientation which better coordinates national economic and inter-industrial goals should be given a larger part, next to stricter selection and concentration of financial and mental resources. Thus, for example, the NTDC seeks to divide and decrease the risks for each enterprise in technical development projects which serve more than short-range enterprise interests.

Why Is Separation Necessary?

[Question] It is apparent that for realization of longer-range national economic goals, coordination of enterprise-industrial directions is necessary; for this, central bases provide the financial impetus. But why must development and technical development be considered separately at enterprises?

[Answer] Development and R. & D are two different activities. I know that in principle, no enterprise is its own enemy; even if an enterprise creates no separate base for development, technical development will not be neglected. Yet in practice, for a variety of reasons, a separate development base is necessary as a kind of safety valve. The presence of technical needs also serves as a jolt which necessitates handling a development base. Original, significant ideas can rarely be pre-programmed. World market conditions change too quickly

for innovation to beat them, but we must work systematically at building a foundation for a long-range structure. Today, new results or development goals require the cooperative development of many enterprises or even branches of industry, which simple daily market automatism will not bring about. Thus the various special interests must be influenced through state coordination and support.

I am convinced that if, in the period of rapid growth, we had not created an enterprise interest in long-range industrial policy, then with today's more measured growth, it would be a waste not to utilize the slightly more independent, more market-oriented development bases.

All this does not imply that I find the present system of creating a technical development base immovable. Quite the contrary, it is my experience that we have not yet been able to coordinate the need for product development and the development keys. One relief is the modification instituted in 1979 that allows enterprises certain degrees of freedom in establishing the development base for each product, in order to determine how much of this base the market price will support. But it was precisely the implementation of the competitive price system that pointed out newer inequalities, which msut be examined.

[Question] The resounding theme of our discussion is that in technical development decisions, daily economic concerns and long-range industrial policy interests are at odds. Is this necessary?

[Answer] I think it is necessary that this clash is more apparent today than it was in past years. The same is happening all over the world. However, it is not necessary that we should set these processes against each other, considering the burdens on the national economy, the lack of balance, and the general recession. We are not dodging the issue, but rather we are forced to make crucial decisions even when we know that they do not coincide with our longer-range technical development conceptions. It is worthwhile to consider, on the other hand, why the average age of our products is still so high--statistically 5-7 years; this problem is becoming urgent. I think that lack of money for new investment is only one cause. An equally detrimental factor is a lack of an adequately coordinated, progressive industrial policy, due to institutional and industrial development direction causes. In my opinion, faster and more concentrated rebuilding of the productive system can be realized in the structural movements of the national economy, based and built on them. The open 5-year and 1-year plans, which are sensitive to world market influences, can only provide the economic framework for this process.

Industrial Policy Connections

[Question] How are industrial and technical development policy related?

[Answer] Some propose a superior-subordinate relationship between industrial policy and technical development efforts; but these processes can develop only through coordination and mutual reinforcement. Without pushing my own interests, I can state that the NTDC can play a larger role in the future; we do not concern ourselves with just one area of development, but ahve the means for exploring and coordinating interbranch connections and common technical development points.

Despite the present difficult economic circumstances, technical development
could accelerate if we would take better advantage of the possibilities of
capital movement among the various economic organizations. The use of technical
development funds rests on precisely this point: we do not request more money
from the budget, but redistribute one-third of enterprise development resources
in those areas which will be more profitable to the national economy. The
great responsibility of today's technical development is to transmit the
necessary longer-range development impulses to the enterprises in time.

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